# SOIL SURVEY

# Pike County Pennsylvania

OUR SOIL ★ OUR STRENGTH

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
THE PENNSYLVANIA STATE UNIVERSITY
College of Agriculture and Agricultural Experiment Station
and
THE PENNSYLVANIA DEPARTMENT OF AGRICULTURE
State Soil and Water Conservation Commission
Issued June 1969

Major fieldwork for this soil survey was done in the period 1961–64. Soil names and descriptions were approved in 1966. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1966. This survey was made cooperatively by the Soil Conservation Service, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission. It is part of the technical assistance furnished to the Pike County Soil and Water Conservation District.

# HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of Pike County contains information that can be applied in managing farms, and woodlands; in selecting sites for roads, ponds, buildings, or other structures; and in determining the value of tracts of land for agriculture, industry, or recreation.

## Locating Soils

All of the soils of Pike County are shown on the detailed map at the back of this survey. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with numbers shown on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

## Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the survey. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit. It also gives the woodland group in which the soil has been placed.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and information in the text. Interpretations not included in the text can be developed by grouping the soils according to their suitability or limitations for a particular use. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

*Farmers and those who work with farmers* can learn about use and management of the soils in the soil descriptions and in the discussions of the capability units and other groupings.

*Foresters and others* can refer to the section "Use of Soils as Woodland," where the soils of the county are grouped according to their suitability for trees.

*Game managers, sportsmen, and others concerned with wildlife* will find information about soils and wildlife in the section "Use of Soils for Wildlife."

*Community planners and others concerned with community development* can read about the soil properties that affect the choice of homesites, industrial sites, schools, and parks in the sections "Soils in Community Developments" and "Use of Soils for Recreation."

*Engineers and builders* will find, under "Engineering Uses of the Soils," tables that give engineering properties of the soils in the county and that name soil features that affect engineering practices and structures.

*Scientists and others* can read about how the soils were formed and how they are classified in the section "Formation and Classification of Soils."

*Newcomers in Pike County* may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County."

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# Contents





Issued June 1969

# SOIL SURVEY OF PIKE COUNTY, PENNSYLVANIA

BY DAVID C. TAYLOR, SOIL CONSERVATION SERVICE

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE PENNSYLVANIA STATE UNIVERSITY, COLLEGE OF AGRICULTURE AND AGRICULTURAL EXPERIMENT STATION, AND THE PENNSYLVANIA DEPARTMENT OF AGRICULTURE, STATE SOIL AND WATER CONSERVATION COMMISSION

PIKE COUNTY lies in northeastern Pennsylvania and is separated from New Jersey and New York States by the Delaware River (fig. 1). Pike County is an important part of this tri-State area in which the general economy is dominated by New York City, 70 miles to the southeast. People of the metropolitan areas around New York City and in northern New Jersey look to this tri-State area for much of their recreation and most of their water supply.

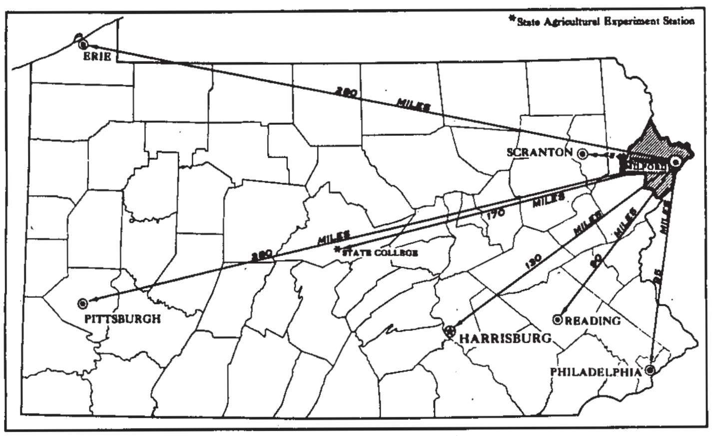


*Figure 1.*—**Location of Pike County in Pennsylvania.**

About 91 percent of Pike County is forested; farming is of minor importance. The lake-studded, wooded landscape with its plentiful population of bear, deer, small animals, and birds is a natural setting for summer cottages and hunting camps and for general outdoor recreation throughout the year. Opportunities for water sports include those for sailboating on the still waters of the lakes and for white-water canoeing on the rapid waters of the Delaware River. The recreation industry dominates the economic life of the county.

The land area of Pike County is 545 square miles, or 348,800 acres. State forest lands comprise 62,893 acres, and State game lands, 20,951 acres. Two State parks comprise approximately 4,000 acres each.

A large multipurpose dam is planned at Tocks Island on the Delaware River, just south of Pike County. This development will provide for flood control, hydroelectric power, and recreation. A large park is planned for part of the area surrounding the reservoir.

The population in 1960 was 9,158. None of the towns has as many as 2,500 inhabitants. The population of the county reached its peak of 9,663 in 1880 when the lumbering industry was active, declined to 7,452 in 1940, and has since increased. A further increase may take place when the Tocks Island Reservoir is built and recreational facilities are developed around the reservoir.

The major industry was formerly the harvesting of timber and bark from the forests. This industry declined as the forests were cut over. Farming, always a minor occupation, has declined since 1950. In 1964 there were 100 farms and the total land in farms was 39,008 acres.

## *How This Survey Was Made*

Soil scientists made this survey to learn what kinds of soils are in Pike County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this survey efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geo-

graphic feature near the place where a soil of that series was first observed and mapped. Chenango and Dekalb, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Chenango cobbly sandy loam and Chenango gravelly loam are two soil types in the Chenango series. The difference in texture of their surface layers is apparent from their names.

Some types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Chenango gravelly loam, 0 to 3 percent slopes, is one of two phases of Chenango gravelly loam, a soil type that ranges from nearly level to sloping.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that greatly help in drawing boundaries accurately. The soil map in the back of this survey was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed and so small in size that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it, for example, Dekalb-Swartswood very stony sandy loams, 0 to 12 percent slopes. Also, most surveys include areas where the soil material is so rocky, so shallow, or so frequently worked by wind and water that it cannot be classified by soil series. These areas are shown on a soil map like other mapping units but are given descriptive names, such as Stony and cobbly alluvial land or Riverwash, and are called land types.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in soil surveys. On basis of the yield and practice tables and other data, the soil scientists set up trial groups, and then test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

## General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Pike County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The seven soil associations in Pike County are described in the following paragraphs. More detailed information about the soils is given in the section "Descriptions of the Soils."

### 1. Chenango-Tunkhannock-Tioga Association

*Deep, well-drained, nearly level to gently sloping, dominantly gravelly soils on low terraces in major stream valleys*

Most of this soil association consists of nearly level to gently sloping low terraces and flood plain deposits in which the soil materials are stratified silt, sand, and gravel. The largest areas are in the valleys of the Delaware and the Lackawaxen Rivers. The association makes up about 10 percent of the county.

Chenango soils make up about 40 percent of this association. They are deep, well-drained, gravelly or cobbly soils developed in glacial outwash that was derived mainly from gray sandstone and shale. The gravelly Chenango soils are nearly level to gently sloping soils on the terraces. The cobbly Chenango soils have complex slopes, and many of them lie on higher terraces than the gravelly soils.

Tunkhannock soils make up about 25 percent of this association. They are deep, well-drained, gravelly soils. They developed in glacial outwash that was derived mostly from

red sandstone and shale. The Tunkhannock are nearly level to gently sloping soils on terraces and kame deposits.

Tioga soils make up about 20 percent of this association. They are deep, well-drained, loamy and sandy soils that were formed in alluvium. Tioga soils are nearly level and gently sloping soils on the low terraces and flood plains. They have few limitations for most kinds of farming (fig. 2).

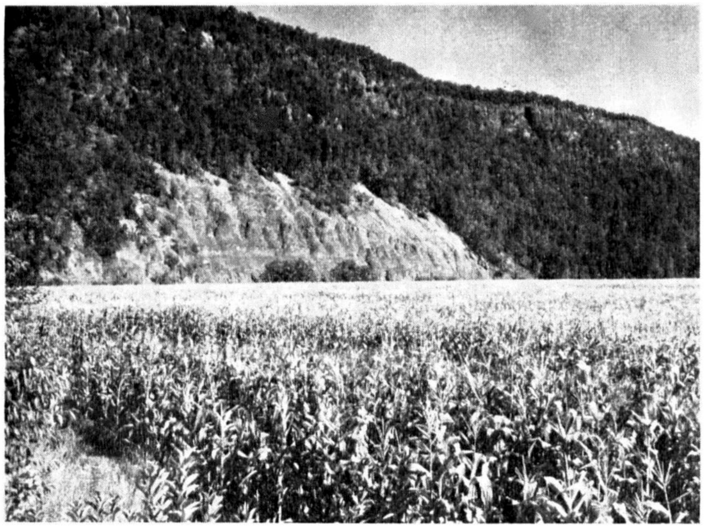

*Figure 2.*—**Corn on Tioga soils in association 1. In the background are bluffs along the Delaware River.**

Minor soils in the association are the Middlebury, Braceville, Red Hook, and Atherton. Middlebury soils are similar to Tioga soils, except that they are moderately well drained. Braceville, Red Hook, and Atherton soils are similar to Chenango and Tunkhannock soils, except that they are less well drained and are in depressions, oxbows, and flats that receive more surface water or are ponded in the spring and after floods.

Most of this association has been cleared and farmed, but some of the complex, irregular slopes of the kames are wooded. The association contains much of the best farmland in the county.

## 2. Holly-Papakating-Peat and Muck Association

*Deep, poorly drained and very poorly drained, nearly level soils on flood plains and in upland depressions*

This soil association consists of nearly level soils on flood plains and in closed depressions of the uplands. The soils receive large amounts of surface runoff, have slow or very slow surface drainage, and are frequently flooded or ponded. Most of the soils are finer textured than the better drained soils in surrounding soil associations. The association makes up about 6 percent of the county.

Holly soils make up about 40 percent of this association. They are nearly level, poorly drained silt loams in alluvial sediments along the streams. Holly soils have a high water table that limits their use for cultivated crops.

Papakating soils make up about 30 percent of this association. They are very poorly drained, dark-colored, level soils developed in alluvial sediments in depressions and oxbows on the flood plains. Papakating soils are very frequently flooded, and they have a high water table that limits their use.

Peat and Muck soils make up about 30 percent of the association. They are organic soils developed from plant and animal remains. The organic materials accumulated in closed depressions where a high water table persists or in ponds that have gradually been filled with plant materials. Most of these organic soils are shallow over mineral soil, but some are deep and may be suitable for intensive cultivation if they are drained. Unless they are drained, the high water table limits their use. Both Peat and Muck are subject to subsidence, and the organic layers should be removed before heavy structures are built.

All the soils in this association are severely limited by their high water table and flooding hazard. Only a few areas have been cleared and farmed. Most of the association consists of forests, natural meadows, or swamps.

## 3. Wurtsboro-Mardin-Swartswood Association

*Deep, moderately well drained and well drained, gently sloping to sloping, loamy soils on the uplands*

This soil association consists of gently sloping to sloping soils of the uplands. Convex slopes prevent accumulation of surface water. The soils were formed in gray glacial till and are very stony, except in places where stones have been removed. This association is mainly in the eastern and central parts of the county. It makes up about 26 percent of the county.

Wurtsboro soils make up about 50 percent of the association. They are moderately well drained, loamy, very stony soils that have a compact, fragipan subsoil. They are gently sloping to moderately steep soils of the uplands. The fragipan impedes growth of roots and slows movement of water through the soil. A seasonal high water table and stones limit the use of the Wurtsboro soils for crops or as building sites.

Mardin soils make up about 25 percent of the association. They are deep, moderately well drained, stony soils that have a fragipan. They were formed in grayish glacial till. The fragipan impedes growth of roots and slows movement of water. The Mardin soils are higher in natural fertility and water-holding capacity than the Wurtsboro soils. Many areas have been cleared and cultivated.

Swartswood soils make up about 15 percent of the association. They are deep, well-drained, very stony sandy loams that were formed in grayish glacial till. They are gently sloping to moderately steep and have good surface drainage. Most areas of Swartswood soils are wooded.

Volusia and Tughill soils occupy about 10 percent of the association. Volusia soils are somewhat poorly drained and poorly drained. They have concave slopes, and they contain a strong fragipan that limits the rooting depth and the capacity to hold moisture that plants can use. The Tughill soils are very poorly drained soils in depressions that receive much surface water. They are frequently ponded. The Volusia and the Tughill soils are limited for farming.

Most of this association is wooded, and only small areas have been cultivated. The soils have low natural fertility.

## 4. Volusia-Tughill-Morris-Norwich Association

*Deep, somewhat poorly drained to very poorly drained, nearly level to sloping, loamy soils having concave slopes; in valleys and closed depressions on uplands*

This association occurs throughout the county in upland valleys where surface drainage is slow to very slow. The soils developed in red and gray glacial till that was derived from siltstone and sandstone. Fairly large areas are stony. This association makes up about 12 percent of the county.

Volusia soils occupy about 35 percent of this association. They are deep, poorly drained and somewhat poorly drained, loamy soils that formed in gray glacial till. They have concave slopes or are in depressions, and they have a seasonal high water table. Volusia soils have a well-developed fragipan that impedes growth of roots and slows movement of water.

Tughill soils occupy about 35 percent of this association. They are very poorly drained, grayish soils in closed depressions, and most of them are swampy. Tughill soils have little potential for use as cultivated fields or as building sites, because they are saturated most of the year.

Morris soils occupy about 15 percent of this association. They are somewhat poorly drained and poorly drained, reddish or brownish soils that have a well-developed fragipan. These soils are on plane to concave slopes and in depressions where surface water accumulates. Morris soils are similar to Volusia soils, except for their brownish or reddish color. The fragipan impedes growth of roots and slows movement of water.

Norwich soils occupy about 10 percent of this association. They are very poorly drained, grayish and brownish soils that have concave slopes or are in closed depressions. These soils are saturated most of the year and so have little potential for use as cropped fields or as building sites.

Poorly drained and very poorly drained soils of the flood plains and some areas of Peat and Muck occupy about 5 percent of this association.

All the soils of this association have a high water table. Because of their wetness, they are severely limited in use, but they can be used for pasture, trees, or wildlife habitats. Most of the association is wooded.

## 5. Culvers-Cattaraugus-Morris Association

*Deep, well-drained to somewhat poorly drained, gently sloping to moderately steep, stony and channery soils on uplands*

This soil association is gently sloping to moderately steep and is mainly in the western part of the county. The soils were formed in reddish or brownish glacial till that was derived from red sandstone and shale. Large areas of the association are very stony. This association makes up about 24 percent of the county.

Culvers soils occupy about 45 percent of this association. They are moderately well drained, brownish, loamy, channery to extremely stony soils that have smooth slopes and receive a moderate amount of surface water. Culvers soils have a well-developed fragipan that slows movement of water through the soil and impedes growth of roots.

Cattaraugus soils occupy about 40 percent of this association. They are deep, well-drained, reddish-brown sandy loams to loams that have smooth, convex slopes. Most of the Cattaraugus soils are gently sloping to moderately steep and are stony. They are limited by these features for use as cultivated fields.

Morris soils occupy about 10 percent of the association. They are deep, somewhat poorly drained and poorly drained, loamy, reddish-brown to brown soils that have smooth, plane or concave slopes. Morris soils have a well-developed fragipan that impedes growth of roots, slows movement of water through the soil, and produces a seasonal high water table.

Norwich and other minor soils occupy about 5 percent of this association. Norwich soils are very poorly drained soils in depressions, where they receive much surface runoff. As a result, they are kept wet by a high water table during most of the year.

The soils in this association have medium to low available moisture capacity and moderate natural fertility. The gently sloping, nonstony Culvers and Cattaraugus soils, however, are some of the best in the western part of the county for farming. About 50 percent of the association has been cleared and cultivated.

## 6. Dekalb-Manlius-Oquaga Association

*Moderately deep and deep, well-drained, gently sloping to steep, very stony and shaly soils on uplands*

This soil association consists of gently sloping to steep soils next to the bluffs along the Delaware River, on the steep valley walls of the Lackawaxen River, and along minor tributaries of both rivers. Some areas are also on high ridges where the glaciers removed most of the old, unconsolidated material and left only a thin layer of till or residuum. This association makes up about 18 percent of the county.

Dekalb soils make up about 40 percent of this association. They are moderately deep or deep, well-drained, very stony or extremely stony sandy loams on smooth ridgetops that were scraped by glaciers, and on gently sloping to very steep hillsides. Most of the Dekalb soils were formed in material that was derived from gray sandstone. Stones, moderate depth to bedrock, and moderately steep to very steep slopes are the major limitations of the Dekalb soils.

Manlius soils make up about 40 percent of this association. They are moderately deep, well-drained soils formed in material that was derived from shale. They are on smooth, glacially scraped ridgetops and strongly sloping to very steep hillsides in the eastern part of the county. Large areas of Manlius soils are along the Delaware River bluffs and west of them. Almost all the areas are just west of the Delaware River. Fairly large areas of Manlius soils have been cleared and farmed. Many of the fields are now idle, however, and are covered with shrubs and trees (fig. 3).

Oquaga soils make up about 20 percent of this association. They are moderately deep or deep, well-drained, reddish-brown, loamy soils formed in material that was derived from red shale and sandstone. These soils occupy smooth, glacially scraped ridgetops and strongly sloping hillsides in the western part of the county. They are also along the valley of the Lackawaxen River. Most of the areas are wooded. The major limitations of Oquaga soils are their low available moisture capacity, their moderate depth, and the many ledges and outcrops of bedrock.

Most of this association is wooded.

*Figure 3.*—**Manlius rocky silt loam, 12 to 30 percent slopes, in association 6. This field formerly was farmed but now is idle. The plant cover consists of broomsedge, povertygrass, shrubs, and trees.**

## 7. Stony Land-Rushtown Association

*Chiefly steep, stony and shaly areas along the river bluffs*

This association consists of steep and very steep areas adjacent to the valley of the Delaware River. It includes the major escarpments that face the river and the sides of valleys that have been cut into the eastern edge of the uplands. The major parts are the cliffs or bluffs themselves and the Rushtown soils that are in the colluvial deposits at the foot of the bluffs (fig. 4). The association makes up about 4 percent of the county.

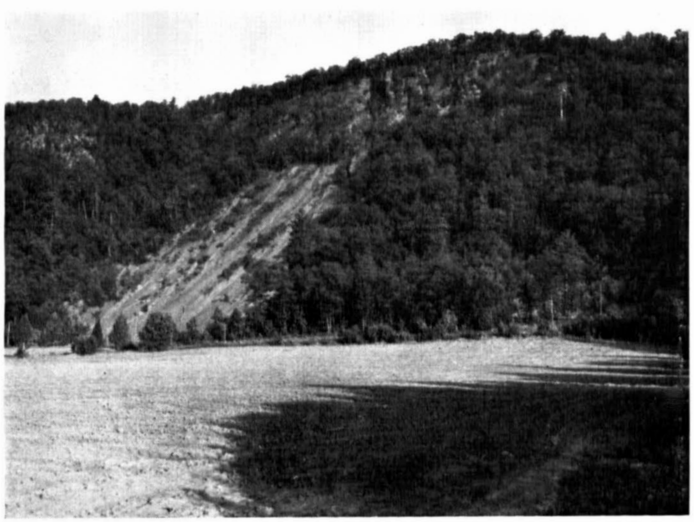

*Figure 4.*—**In the background are bluffs of association 7, along the Delaware River. These bluffs consist of Stony land, steep, and Rushtown soils. In the foreground is Middlebury loam, a minor soil in association 1.**

Stony land, steep, makes up about 80 percent of this association. This miscellaneous land type consists mostly of exposed shale, siltstone, and sandstone bedrock. In some small, protected areas, shallow or very shallow soils have been formed. Vegetation is sparse. The slopes are too steep and the soil is too shallow for production of commercial timber.

Rushtown soils make up about 20 percent of the association. They are deep, well-drained, very shaly soils that have little or no subsoil development. They were formed in colluvial deposits of shale chips that accumulated at the foot of the bluffs. Rushtown soils are droughty, because they contain only small amounts of silt and clay and their steep slopes promote runoff. The material in which the Rushtown soils were formed is loose and easily excavated. Large amounts of the very shaly substratum have been removed for use in making fills and in surfacing roads and walks.

This association is limited for most uses because of the steep and stony soils. The rugged, steep slopes add scenic beauty to the river valleys.

# *Use and Management of Soils*

The soils of Pike County are used for grain and food crops, pasture, and trees. In the following pages, the system of capability classification used by the Soil Conservation Service is explained. Then, the management by capability units is discussed and the relative productivity of the soils is given. This is followed by a discussion of management of the soils for use as woodland and for wildlife, engineering, community developments, and recreation.

## Capability Groups of Soils

Capability classification is the grouping of soils to show, in a general way, their suitability for most kinds of farming. It is a practical classification based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. The classification does not apply to most horticultural crops, or to rice and other crops that have their special requirements. The soils are classified according to degree and kind of permanent limitation, but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soils; and without consideration of possible but unlikely major reclamation projects.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

Capability Classes, the broadest grouping, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. Classes are defined as follows:

Class I. Soils have few limitations that restrict their use.

Class II. Soils have some limitations that reduce the choice of plants or require moderate conservation practices.

Class III. Soils have severe limitations that reduce the choice of plants, or require special conservation practices, or both.

Class IV. Soils have very severe limitations that restrict the choice of plants, require very careful management, or both.

Class V. Soils subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover. (There are no soils of class V in Pike County.)

Class VI. Soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

Class VII. Soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Class VIII. Soils and landforms have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in some parts of the United States but not in Pike County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only subclasses indicated by *w*, *s*, and *c*, because the soils in it are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIe-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation, and the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs. The Arabic numeral specifically identifies the capability unit within each subclass.

### *Management by Capability units*

The soils in one capability unit have about the same limitations and similar risks of damage. All of the soils in one unit, therefore, need about the same kind of management, although they may have been formed from different kinds of parent material and in different ways.

The capability units are described in the following pages. The soils and their respective capability units are listed in the "Guide to Mapping Units" just ahead of the map section of this survey. Management suitable for all the soils in one unit is suggested. Suitable cropping systems are described for many of the capability units in terms of rotations of *high*, *medium*, *low*, or *very low* intensity. It is assumed that the needed erosion control practices are used with each cropping system.

High-intensity (4-year) rotations consist of 1 year of a row crop followed by a cover crop, 1 year of a row crop, 1 year of a small grain, and 1 year of hay or pasture.

Medium-intensity (3-year) rotations consist of 1 year of a row crop, 1 year of a small grain, and 1 year of hay.

Low-intensity (4-year or 5-year) rotations consist of 1 year of a row crop, 1 year of a small grain, and 2 or 3 years of hay.

Very low intensity (5-year or longer) rotations consist of 1 year of a row crop, 1 year of a small grain, and 3 or more years of hay.

A rotation can be modified slightly, depending on the needs of the farmer and the intensity of soil and water conservation practices.

Conservation practices that can be applied on sloping soils are contour stripcropping, terraces, and sod waterways. On sloping, wet soils surface water can be drained and erosion can be controlled by use of graded strips, terraces, and grassed waterways. Subsurface water can generally be removed by random tile lines or open ditches, if suitable outlets are available.

Practices to maintain and improve the organic-matter content and soil structure and to reduce erosion include the growing of winter cover crops, stubble mulching, and minimum tillage; and the growing of green-manure crops if the rotation is intensive or the cultivation is continuous.

Lime and fertilizer should be applied according to soil tests and the needs of the crop.

Additional help in managing the soils can be obtained by consulting a local representative of the Soil Conservation Service, the County Agricultural Agent, or a member of the Staff of the State Agricultural Experiment Station.

The names of soil series represented are mentioned in the description of each capability unit, but this does not mean that all the soils of a given series appear in the unit. To find the names of all the soils and the capability unit in which each one has been grouped, refer to the "Guide to Mapping Units" at the back of this survey.

#### CAPABILITY UNIT I-1

This unit consists of deep, nearly level, well-drained soils on flood plains and terraces along the major streams. The soils are in the Chenango and Tioga series. These soils have moderate available moisture capacity and rapid permeability to water and air. They warm up quickly in spring.

These soils are well suited to farm crops and truck crops grown in a rotation of high intensity. They are easily cultivated, and most crops respond well to a high level of management. These soils are suited to alfalfa, but they are too droughty to keep permanent pasture producing well during summer. Natural drainageways should be kept in sod.

Crops on some areas of these soils can be irrigated, if desired, with water from the nearby streams.

#### CAPABILITY UNIT IIe-1

This capability unit consists of deep, gently sloping soils on terraces and uplands. The soils are in the Braceville, Cattaraugus, Chenango, and Swartswood series. They have low to high available moisture capacity and rapid to slow permeability to water and air. All of them except the Braceville soil are well drained, and the Braceville

soil is moderately well drained. These soils warm up quickly in spring but are subject to moderate erosion if they are not protected.

The soils of this unit are suited to general farm crops grown in a rotation of medium intensity. Contour stripcropping, waterways, and diversion terraces are needed to control runoff and erosion on long slopes. Some drainage of the Braceville soil may be needed, because alfalfa grown on that soil tends to winterkill as a result of wetness. The Chenango soil is too droughty for high production of permanent pasture in summer.

### CAPABILITY UNIT IIs-1

This capability unit consists of deep, well-drained, nearly level to gently sloping soils on flood plains, high bottoms, and terraces along the major streams. These soils are in the Chenango, Tioga, and Tunkhannock series. They are moderately limited by their moderate to low available moisture capacity. They have rapid permeability to water and air. The soils warm up quickly in spring.

These soils are suited to general farm crops grown in a rotation of medium intensity. They are too droughty for best production of pasture in summer. Surface runoff and erosion on long slopes can be controlled by contour stripcropping, diversion terraces, and sod waterways. Water for irrigation of some areas can be obtained from the nearby streams.

### CAPABILITY UNIT IIw-1

This capability unit consists of deep, moderately well drained, nearly level and gently sloping soils on flood plains, terraces, and glaciated uplands. These soils are in the Braceville, Culvers, Mardin, and Middlebury series. They have moderate available moisture capacity and moderate to slow permeability to water and air. They warm up slowly in spring. The areas in depressions are covered by shallow water during wet seasons. Excess water is a moderate limitation. Depth of the root zone is limited by a firm, brittle layer that generally begins at a depth of about 20 inches.

The soils in this unit are suited to general farm crops grown in a rotation of medium intensity. Legumes and winter grains tend to winterkill.

Surface drainage is needed and can be furnished by keeping natural drainageways open and by providing drainage outlets for the depressions. Also, surface water that flows from higher areas can be diverted. Protection against erosion can be provided by graded stripcrops, sod waterways, and diversion terraces. If outlets are available, tile drains help remove excess subsurface water and make management of the fields easier.

### CAPABILITY UNIT IIIe-1

This unit consists mostly of deep, moderately sloping, well-drained soils on terraces and glaciated uplands. The soils are in the Cattaraugus, Chenango, Manlius, Oquaga, Swartswood, and Tunkhannock series. These soils have moderate to low available moisture capacity and slow to rapid permeability to water and air. They warm up quickly in spring. They are severely limited by the risk of erosion if they are cultivated and not protected. The Oquaga and Manlius soils are moderately deep to deep over bedrock.

The soils in this unit are suited to general farm crops grown in a rotation of low intensity. Erosion can be controlled by using contour stripcropping, diversion terraces, and waterways. Permanent pastures on the Chenango, Manlius, and Oquaga soils produce only small amounts of forage in summer because those soils have low or very low available moisture capacity.

### CAPABILITY UNIT IIIe-2

This capability unit consists of deep, moderately well drained, moderately sloping soils of the glaciated uplands. These soils are in the Culvers and Mardin series. Depth of their root zone is limited by a firm, brittle, slowly permeable layer that generally begins at a depth of about 20 inches. Above this layer the soil has moderate available moisture capacity and moderate permeability to water and air. These soils warm up slowly in spring. They are limited by the risk of severe erosion if they are cultivated and not protected.

These soils are suited to general farm crops grown in a rotation of low intensity. Alfalfa tends to die out early on them. These soils are not well suited to winter grain or root crops.

These soils can be protected against erosion by controlling runoff through the use of contour stripcrops, sod waterways, and diversion terraces.

### CAPABILITY UNIT IIIw-1

This capability unit consists of deep, nearly level and gently sloping soils on glaciated uplands and on terraces. The soils are in the Atherton, Morris, Red Hook, and Volusia series. Depth of the root zone in these soils is limited by a slowly permeable fragipan that generally begins at a depth of 12 to 15 inches. Above the fragipan the soils have moderate available moisture capacity and are moderately permeable to water and air. These soils are somewhat poorly and poorly drained, except the Atherton soil, which is poorly and very poorly drained. Excess water in all the soils is a severe limitation, and the soils warm up slowly in spring.

These soils are suited to general farm crops grown in a rotation of low intensity. Most legumes and winter grains growing on these soils tend to be winterkilled or to be heaved out by freezing.

Excess water can be drained from the surface of these soils by keeping the natural drainageways open. Tile drains generally are not satisfactory, because all the soils have a slowly permeable fragipan. Tile drains are likely to be more effective in the Atherton and Red Hook soils than in the others, because those soils have sand and gravel beneath the slowly permeable fragipan.

On the gently sloping soils of this unit, graded strips, sod waterways, and diversion terraces are needed to control runoff and erosion.

### CAPABILITY UNIT IVe-1

This capability unit consists of deep, well-drained, moderately steep soils of the terraces and glaciated uplands. The soils are in the Chenango and Tunkhannock series. They have low available moisture capacity and rapid permeability to water and air. They warm up quickly in spring. Because these soils are moderately steep, they are subject to very severe erosion if they are cultivated and not protected.

These soils are suited to farm crops grown in a rotation of very low intensity. They are suited to long-term hay. Drought-tolerant varieties of crops should be planted if

they are available. Contour strips, diversion terraces, and sod waterways are measures to help control runoff and erosion.

#### CAPABILITY UNIT IVw-1

This capability unit consists of deep, level or nearly level, very poorly drained and poorly drained soils on the glaciated uplands and on flood plains. The soils are in the Holly, Norwich, and Tughill series. They have moderate to high water-supplying capacity, but the depth of the root zone is limited by a seasonal high water table. The excess water limits the soils severely for cultivation. These soils warm up slowly in spring.

The soils of this unit are suited to cultivated crops grown in a rotation of very low intensity, but they can be managed more easily if they are used for long-term hay or pasture. Most winter grains and tall legumes winterkill on these soils.

Surface water can be removed by keeping the natural drainageways open and providing outlets to drain the depressions. Surface water that flows from higher areas should be diverted. Tile drains can be installed in some places.

#### CAPABILITY UNIT VIs-1

This capability unit consists of very stony and rocky, gently sloping and moderately steep soils on glaciated uplands. The soils are in the Cattaraugus, Culvers, Dekalb, Manlius, Mardin, Oquaga, Swartswood, and Wurtsboro series. The Cattaraugus and Swartswood soils are deep and well drained. Dekalb, Manlius, and Oquaga soils are moderately deep or deep over bedrock. Culvers, Mardin, and Wurtsboro soils are moderately well drained.

The soils of this unit have moderate to low available moisture capacity and slow to rapid permeability to water and air. Their stoniness and rockiness make them generally unsuitable for cultivation and limit them for other uses. They can be used for pasture, but they generally are too stony to be managed intensively. Many areas are wooded.

#### CAPABILITY UNIT VIs-2

Stony and cobbly alluvial land is in this capability unit. It is a deep, nearly level and gently sloping land type on alluvial fans and in drainageways. It is of variable drainage and texture and is very severely limited by its low or very low available moisture capacity. It has rapid permeability to water and air.

This land type supports grass and shrubs and may be used for permanent pasture, but generally the areas are too stony and cobbly to be managed intensively. All the areas are flooded frequently.

#### CAPABILITY UNIT VIw-1

This capability unit consists of a deep, nearly level, very poorly drained soil on flood plains. The soil is Papakating silt loam. This soil is flooded frequently. A high water table limits the depth of the root zone. This soil is covered with water for long periods in spring. The excess water makes it unsuited to cultivation and limited for other uses.

Without drainage, this soil can be used only for seasonal pasture. Grasses that tolerate wetness can be grown. Some flooding can be prevented by keeping the natural floodways open and, wherever possible, by diverting surface water that flows from higher areas.

#### CAPABILITY UNIT VIIe-1

This capability unit consists of a deep, well-drained, steep soil at the base of long slopes. The soil is Rushtown very shaly silt loam, 25 to 45 percent slopes. This soil has low to moderate available moisture capacity and rapid permeability to water and air. It is very severely limited for use, chiefly by the risk of erosion if protective cover is not maintained.

This soil is suited to trees. It is too steep and droughty for cultivated crops, hay, or pasture.

#### CAPABILITY UNIT VIIs-1

This capability unit consists of moderately deep to deep, well drained to poorly drained, very rocky, and very stony to extremely stony soils. These soils are in the Cattaraugus, Culvers, Dekalb, Manlius, Morris, Norwich, Oquaga, Swartswood, and Volusia series. They have very low to moderate available moisture capacity and rapid permeability to water and air. Their stoniness and rockiness are a very severe limitation for any kind of use.

These soils are too stony or steep to be used for crops or pasture. They are fairly well suited to trees.

#### CAPABILITY UNIT VIIs-2

This unit consists of a deep, very poorly drained, very stony, nearly level to gently sloping soil of the uplands. The soil is Tughill very stony loam, 0 to 3 percent slopes. Most areas of this soil are on flats or in closed depressions or drainageways that have concave slopes. The stoniness and wetness are very severe limitations. This soil has moderate available moisture capacity and is moderately permeable to water and air.

This soil is too stony for cultivation. It cannot be cleared economically for intensive use for pasture, hay, or field crops.

#### CAPABILITY UNIT VIIw-1

This capability unit consists of nearly level, very poorly drained Muck and Peat. These organic soils occupy depressions in the glaciated uplands. The water table lies at or above the surface during all but the summer months. Wetness of these soils is a very severe limitation. The individual areas are small, and their total extent in the county is small.

These soils have not been cleared for cultivation. It is costly to develop the areas for farming. If improved, these soils are suitable for intensive use in production of vegetables. If too much water is drained off, however, the organic material shrinks, the surface becomes lower, and drainage then is more difficult than it was at first. If interest develops in cultivating these soils, individual areas should be studied to determine the possibility of reclamation. These soils can be used as a source of organic material.

#### CAPABILITY UNIT VIIIs-1

This capability unit consists of Riverwash and two mapping units of Stony land. The areas of Riverwash consist of nearly level, droughty, cobbly, gravelly, or sandy deposits left by streams on islands, deltas, and beaches along the Delaware and Lackawaxen Rivers. The areas are subject to frequent flooding, and they shift frequently. Removal and deposition by the streams and gouging by floating ice discourage growth of any except annual plants. Depth to the water table is that to the water level of the

adjacent stream. Riverwash tends to be droughty during the growing season.

The areas of Stony land lie in the uplands and range from nearly level to steep. The two mapping units of Stony land have a stony surface and only a small amount of soil material between the stones.

The land types in this capability unit are not suited to field crops, pasture, or trees grown commercially. They can be used as sites for recreation.

## Productivity Ratings

Table 1 shows productivity ratings of the soils suitable for farming for representative field crops grown in the county, pasture, and orchards. These ratings are based on predicted average yields for a period of 10 years or more, not for just one season. Each productivity rating denotes the productivity of the soil for a particular crop in relation to a standard index of 100. The standard index of 100 represents the average yield per acre that is obtained by good management on the more productive soils in the county. The average yield per acre represented by an index of 100 is given at the head of the two columns for each crop.

The predicted productivity ratings are given under two levels of management. In columns A are ratings that indicate yields under the normal or prevailing management used by the average farmer in the county. In columns B

TABLE 1.—*Estimated productivity ratings of soils for specified field and forage crops under two levels of management*

[In columns A are productivity ratings for normal management, and in columns B are ratings for improved management. The absence of data indicates that the soil is not suited to the specified crop at the specified level of management]

| Symbol | Soil | Corn for grain (100=85 bushels per acre) | | Corn for silage (100=17 tons per acre) | | Oats (100=40 bushels per acre) | | Alfalfa-grass hay (100=3.0 tons per acre) | | Grass-legume hay (100=2.5 tons per acre | | Bluegrass pasture (100=85 cow-acre-days) [1] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | A | B | A | B | A | B | A | B | A | B |
| At | Atherton loam | ------ | 45 | ------ | 45 | ------ | 55 | ------ | ------ | 20 | 75 | 35 | 65 |
| BrA | Braceville gravelly loam, 0 to 3 percent slopes | 75 | 120 | 75 | 120 | 85 | 150 | 65 | 120 | 75 | 135 | 55 | 160 |
| BrB2 | Braceville gravelly loam, 3 to 8 percent slopes, moderately eroded | 80 | 125 | 80 | 125 | 85 | 150 | 75 | 125 | 80 | 150 | 60 | 160 |
| CaB2 | Cattaraugus channery sandy loam, 3 to 12 percent slopes, moderately eroded | 70 | 100 | 70 | 100 | 70 | 150 | 75 | 120 | 70 | 160 | 45 | 140 |
| CaC2 | Cattaraugus channery sandy loam, 12 to 20 percent slopes, moderately eroded | 70 | 100 | 70 | 100 | 70 | 150 | 75 | 120 | 70 | 140 | 45 | 140 |
| CgB | Cattaraugus very stony sandy loam, 0 to 12 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 40 | ------ |
| CgD | Cattaraugus very stony sandy loam, 12 to 30 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 35 | ------ |
| ChB | Chenango cobbly sandy loam, 3 to 12 percent slopes | 70 | 100 | 70 | 100 | 50 | 110 | 80 | 120 | 70 | 90 | 45 | 140 |
| ChC | Chenango cobbly sandy loam, 12 to 20 percent slopes | 65 | 90 | 65 | 90 | 45 | 100 | 75 | 110 | 60 | 80 | 45 | 140 |
| ChD | Chenango cobbly sandy loam, 20 to 30 percent slopes | 55 | 75 | 55 | 75 | 40 | 90 | 65 | 95 | 45 | 70 | 40 | 90 |
| ClA | Chenango gravelly loam, 0 to 3 percent slopes | 75 | 105 | 75 | 105 | 60 | 140 | 85 | 125 | 80 | 115 | 45 | 150 |
| ClB2 | Chenango gravelly loam, 3 to 12 percent slopes, moderately eroded | 75 | 105 | 75 | 105 | 55 | 140 | 85 | 125 | 80 | 115 | 45 | 150 |
| CmB | Chenango gravelly sandy loam, 0 to 12 percent slopes | 70 | 95 | 70 | 90 | 50 | 120 | 85 | 110 | 70 | 90 | 45 | 125 |
| CmC | Chenango gravelly sandy loam, 12 to 20 percent slopes | 65 | 80 | 65 | 80 | 45 | 100 | 75 | 110 | 60 | 90 | 40 | 110 |
| CmD | Chenango gravelly sandy loam, 20 to 30 percent slopes | 55 | 70 | 55 | 60 | 40 | 100 | 65 | 90 | 45 | 80 | 35 | 100 |
| CnB2 | Culvers channery loam, 2 to 8 percent slopes, moderately eroded | 60 | 100 | 60 | 100 | 75 | 150 | 50 | 125 | 80 | 150 | 60 | 175 |
| CnC2 | Culvers channery loam, 8 to 15 percent slopes, moderately eroded | 50 | 95 | 50 | 90 | 70 | 150 | 50 | 110 | 75 | 150 | 60 | 175 |
| CvB | Culvers very stony loam, 0 to 8 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 35 | ------ |
| CvC | Culvers very stony loam, 8 to 25 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 30 | ------ |
| DsB | Dekalb-Swartswood very stony sandy loams, 0 to 12 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 30 | ------ |
| DsD | Dekalb-Swartswood very stony sandy loams, 12 to 30 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 25 | ------ |

See footnote at end of table.

TABLE 1.—*Estimated productivity ratings of soils for specified field and forage crops under two levels of management*—Continued

| Symbol | Soil | Corn for grain (100=85 bushels per acre) | | Corn for silage (100=17 tons per acre) | | Oats (100=40 bushels per acre) | | Alfalfa-grass hay (100=3.0 tons per acre) | | Grass-legume hay (100=2.5 tons per acre | | Bluegrass pasture (100=85 cow-acre-days) [1] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | A | B | A | B | A | B | A | B | A | B |
| Ho | Holly silt loam | ------ | 100 | ------ | 100 | ------ | 115 | ------ | ------ | 70 | 115 | 40 | 140 |
| MaB | Manlius rocky silt loam, 0 to 12 percent slopes | 55 | 80 | 55 | 75 | 40 | 105 | 65 | 110 | 45 | 100 | 40 | 150 |
| MaD | Manlius rocky silt loam, 12 to 30 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 40 | ------ |
| MlB | Manlius very rocky silt loam, 0 to 12 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 40 | ------ |
| MlD | Manlius very rocky silt loam, 12 to 30 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 35 | ------ |
| MnB2 | Mardin channery silt loam, 2 to 8 percent slopes, moderately eroded | 60 | 110 | 60 | 110 | 75 | 150 | 50 | 125 | 80 | 145 | 60 | 160 |
| MnC2 | Mardin channery silt loam, 8 to 15 percent slopes, moderately eroded | 50 | 100 | 50 | 95 | 70 | 150 | 45 | 115 | 75 | 135 | 60 | 160 |
| MoB | Mardin very stony loam, 0 to 8 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 35 | ------ |
| MoC | Mardin very stony loam, 8 to 25 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 30 | ------ |
| Mr | Middlebury loam | 100 | 100 | 100 | 120 | 85 | 160 | 75 | 110 | 105 | 135 | 100 | 160 |
| MsB2 | Morris channery loam, 3 to 8 percent slopes, moderately eroded | 45 | 80 | 45 | 80 | 70 | 130 | 30 | 80 | 60 | 125 | 45 | 160 |
| NoA | Norwich channery silt loam, 0 to 3 percent slopes | ------ | 65 | ------ | 65 | ------ | 55 | ------ | ------ | 35 | 75 | 35 | 65 |
| OaB2 | Oquaga channery loam, 3 to 12 percent slopes, moderately eroded | 50 | 95 | 50 | 95 | 70 | 135 | 55 | 115 | 65 | 115 | 35 | 160 |
| OvB | Oquaga very stony loam, 0 to 12 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 35 | ------ |
| OvD | Oquaga very stony loam, 12 to 30 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 30 | ------ |
| Pa | Papakating silt loam | ------ | 80 | ------ | 80 | ------ | ------ | ------ | ------ | 40 | 80 | ------ | 70 |
| Rh | Red Hook loam | 70 | 100 | 70 | 90 | 85 | 130 | ------ | ------ | 60 | 110 | 60 | 160 |
| Sc | Stony and cobbly alluvial land | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 40 | ------ |
| StB2 | Swartswood channery sandy loam, 3 to 12 percent slopes, moderately eroded | 70 | 100 | 70 | 100 | 70 | 160 | 80 | 140 | 70 | 150 | 45 | 160 |
| StC2 | Swartswood channery sandy loam, 12 to 20 percent slopes, moderately eroded | 60 | 90 | 60 | 90 | 60 | 140 | 75 | 125 | 55 | 140 | 40 | 160 |
| SwB | Swartswood very stony sandy loam, 0 to 12 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 40 | ------ |
| SwD | Swartswood very stony sandy loam, 12 to 30 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 35 | ------ |
| Ta | Tioga loamy fine sand | 45 | 70 | 45 | 110 | 40 | 180 | 95 | 125 | 70 | 110 | 45 | 160 |
| TgA | Tioga loamy fine sand, high bottom, 0 to 3 percent slopes | 45 | 70 | 45 | 110 | 40 | 180 | 95 | 125 | 70 | 110 | 45 | 160 |
| TgB | Tioga loamy fine sand, high bottom, 3 to 12 percent slopes | 45 | 70 | 45 | 110 | 40 | 180 | 95 | 125 | 70 | 110 | 45 | 160 |
| To | Tioga silt loam | 100 | 140 | 100 | 140 | 100 | 180 | 100 | 140 | 100 | 135 | 100 | 160 |
| TsA | Tughill channery silt loam, 0 to 3 percent slopes | ------ | 90 | ------ | 80 | ------ | 130 | ------ | ------ | 55 | 110 | 35 | 120 |
| TuB | Tunkhannock gravelly sandy loam, 3 to 12 percent slopes | 70 | 95 | 70 | 90 | 50 | 120 | 80 | 120 | 70 | 90 | 45 | 120 |
| TuC | Tunkhannock gravelly sandy loam, 12 to 20 percent slopes | 65 | 80 | 65 | 70 | 45 | 90 | 75 | 110 | 60 | 90 | 40 | 105 |
| TuD | Tunkhannock gravelly sandy loam, 20 to 30 percent slopes | 55 | 75 | 55 | 60 | 40 | 90 | 65 | 95 | 45 | 70 | 35 | 90 |
| VcA | Volusia channery loam, 0 to 3 percent slopes | 35 | 70 | 35 | 70 | 55 | 110 | ------ | 40 | 40 | 110 | 40 | 160 |
| VcB2 | Volusia channery loam, 3 to 8 percent slopes, moderately eroded | 40 | 80 | 40 | 80 | 70 | 120 | 30 | 90 | 60 | 140 | 45 | 160 |
| WuB | Wurtsboro very stony sandy loam, 0 to 8 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 50 | ------ |
| WuC | Wurtsboro very stony sandy loam, 8 to 25 percent slopes | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 45 | ------ |

[1] Cow-acre-days is a term used to express the carrying capacity of pasture. It is the number of animal units carried per acre multiplied by the number of days the pasture provides grazing during a single grazing season without injury to the sod. An animal unit is 1 cow, steer, horse, or mule: 5 hogs; or 7 sheep. An acre of pasture that provides 30 days of grazing for 2 cows has a carrying capacity of 60 cow-acre-days.

are ratings that indicate yields that may be obtained in average growing seasons when improved management is practiced. The improved management indicated in columns B is based on the assumption that farmers use most of the adapted crop varieties, rates of fertilization, and control measures for insects and diseases that are currently recommended. Assumptions are also made that management practices are applied at the proper time and in such a way as to be effective; that soil and water conservation practices, such as minimum tillage, contour tillage, stripcropping, crop residue management, diversions, drainage, and controlled waterways, are applied; and that other practices recommended by the Agricultural Extension Service and the Soil Conservation Service in Pike County are followed. Irrigation is not considered in arriving at these yields. The yields in columns B are not intended to be the maximum yields obtainable. The yields in columns B vary for the different soils, but most of them are higher than present yields in the county.

An index of 50 indicates that the soil is only about half as productive for the specified crop as a soil that has an index of 100; an index of more than 100, however, can be assigned to some soils.

Tioga silt loam, for example, has a rating of 100 under prevailing management for corn for grain, oats, alfalfa and grass hay, clover and grass hay, and bluegrass pasture. These ratings mean that under the prevailing level of management on Tioga silt loam, you can expect to obtain yields per acre of 85 bushels of corn, 40 bushels of oats, 3.0 tons of alfalfa and grass hay, 2.5 tons of grass-legume hay, or 85 cow-acre-days of grazing in a bluegrass pasture.

Under improved management this same soil, Tioga silt loam, has a productivity rating of 140 for corn for grain, 180 for oats, 140 for alfalfa and grass hay, 135 for clover and grass hay, and 160 for bluegrass pasture. This means that expected yields per acre under improved management are 119 bushels of corn for grain, 72 bushels of oats, 4.2 tons of alfalfa and grass hay, 3.37 tons of grass-legume hay, and 136 cow-acre-days of grazing in a bluegrass pasture.

## Use of Soils as Woodland [1]

Pike County has about 320,000 acres of woodland. This amounts to about 90 percent of the total land area of the county. Farmers own 8 percent of the woodland, industries and private concerns own 71 percent, and the Pennsylvania Department of Forests and Waters and the Pennsylvania Game Commission own the other 21 percent.

Stands of second- and third-growth trees make up the woodland. The principal forest types (*11*) [2] that make up the present woodland and the extent of each as given by the United States Forest Service (*16*) are as follows:

| Forest type | *Percentage of total woodland in the county* |
|---|---|
| Chestnut oak | 38 |
| Chestnut oak is pure or predominant. The common associates are scarlet oak, black oak, pitch pine, and red maple. | |
| White oak | 20 |
| White oak is predominant. The common associates are black oak, red oak, shagbark hickory, bitternut hickory, ash, and tulip-poplar. | |
| Sugar maple-beech-yellow birch | 12 |
| Sugar maple, beech, and yellow birch are the predominant species. Associated species are basswood, red maple, hemlock, northern red oak, ash, white pine, paper birch, and black birch. | |
| Pitch pine | 6 |
| Pitch pine is pure or predominant. Associates are chestnut oak, scarlet oak, black oak, and Table-Mountain pine. | |
| Red oak | 6 |
| Northern red oak is predominant. Associates are black oak, scarlet oak, chestnut oak, and tulip-poplar. | |
| Other forest types | 18 |

Sawtimber grows on approximately 16 percent of the acreage in commercial forests, and poletimber on 49 percent. Seedlings and saplings grow on the rest (*16*).

In general the soils in this county have low natural fertility and moderate to low available moisture capacity. Repeated fires during the early part of this century, and the practice of cutting the best trees and leaving the poorest, have left the woodland in poor condition. At present, the stands in many wooded areas are made up predominantly of gray birch, white birch, chestnut oak, scarlet oak and red maple. Trees grow slowly on many of the soils in the county.

A landowner can encourage the desirable kinds of trees by using good woodland management. Help in planning a program of woodland improvement can be obtained from local foresters. The amount of effort that the landowner is willing to make toward improving his woodland probably depends on general economic conditions.

Studies have been made of the rate at which trees grow on six soils that are extensive in the county. The results of these studies are on file in the State office of the Soil Conservation Service at Harrisburg, Pa. The trees studied grew on 30 sample plots. The oak index (*9*) of site quality obtained for each of the soils was based on the average height obtained by the tallest trees at the age of 50 years.

Other soils in the county that have characteristics similar to those of the soils studied were assumed to have approximately the same rating. The volume of timber that a normal stand will produce at different ages can be determined by using this index and applicable yield tables.

Information about the soils on which trees and associated plants are growing is basic for efficient management of woodland.

Less than 1 percent of the forested acreage in this county consists of soils that are excellent for woodland sites. Other forested acreage is classified as follows: good sites, 38 percent; fair sites, 53 percent; and poor sites, 8 percent.

The returns from trees on soils that provide excellent and good woodland sites generally justify the expenditure of money for management. Consideration should be given, however, to the potential yield, the quality of the particu-

[1] By V. C. MILES, woodland specialist, Soil Conservation Service.

[2] Italicized numbers in parentheses refers to Literature Cited, p. 82.

lar species growing on the site, and the market potential. The kinds of trees and the number of poor-quality stems growing on an excellent or a good site may prohibit the investment of money for management. The conversion of a poor stand from its present state to one that will yield at the potential capacity of the site may not be economically justifiable.

Soils that provide fair woodland sites are the most difficult to appraise for forest management. A thorough appraisal of the trees as to species and quality is essential. The market possibilities should also be investigated. A proper analysis of all of these interrelated factors is essential to determine the intensity of forest management that is warranted.

The returns from soils that provide poor woodland sites generally will not justify economically any management to increase the yields of wood products. The most practical use of such soils, however, is generally as woodland. Because of unfavorable soil characteristics, such soils generally will not show a profitable return if they are used for field crops or for pasture. Although returns may be slight or none at all if such soils are used as woodland, this use is the most practical one for them.

The value of Pike County woodland is largely that of its esthetic, recreational, and watershed uses. The principal beneficiaries of these values are people from the metropolitan and urban areas. These people are not likely to be interested in the respective merits of one forest species over another for saw logs or for cords of wood. They are likely to be more interested in trees because trees provide comfort and beauty.

### *Woodland suitability groups*

To help in planning management for the soils of this county, soils that have similar characteristics that affect growth of trees have been placed in woodland groups. The soils have been grouped mainly according to similarities in depth, drainage, and available moisture capacity.

Table 2 gives, for each of the woodland groups, a rating of potential productivity, a list of the species best suited to the soils of the group, ratings for the principal hazards that affect the production of timber, and a rating for limitations to the use of equipment for planting and harvesting trees.

*Potential productivity.*—Potential productivity is based on the site index for oak (excluding pin oak, for which the site-growth relationship is different). A site index for oak of 75 or better at age 50 years is rated *excellent*, and the expected yield is 13,750 or more board feet per acre (International rule) (*9*). A site index for oak of 65 to 74 at age 50 years is rated *good*, and the expected yield is about 9,750 board feet per acre. A site index for oak of 55

TABLE 2.—*Potential productivity, suitable trees,*

| Woodland suitability group | Potential [1] productivity | Suitable species | |
|---|---|---|---|
| | | Native trees to favor | Planted trees |
| Group 1 (To) | Excellent | Tulip-poplar, red oak, ash, white pine | Larch, white pine, Austrian pine, Norway spruce. |
| Group 2 (Ta, TgA, TgB) | Fair | Black oak, pitch pine, Virginia pine | Pitch pine, Virginia pine |
| Group 3 (Mr) | Good | Tulip-poplar, red oak, ash, white pine | Larch, white pine, Norway spruce, Austrian pine. |
| Group 4 (Ho) | Fair | White pine, hemlock, red maple, pin oak | White pine, white spruce |
| Group 5 (Pa) | Poor | White pine, hemlock, red maple, pin oak | White pine, white spruce |
| Group 6 (BrA, BrB2, CnB2, CnC2, CuB, CuD, CvB, CvC, MnB2, MnC2, MoB, MoC). | Good | Tulip-poplar, red oak, sugar maple, ash, white pine. | Larch, white pine, Austrian pine, Norway spruce, white spruce. |
| Group 7 (CaB2, CaC2, CeB, CeD, CgB, CgD). | Good | Tulip-poplar, red oak, sugar maple, ash, white pine. | Larch, white pine, Austrian pine, Norway spruce. |
| Group 8 (Rh) | Fair | White pine, red maple, hemlock | White pine, white spruce |
| Group 9 (ChB, ChC, ChD, ClA, ClB2, CmB, CmC, CmD, StB2, StC2, SwB, SwD, TuB, TuC, TuD, WuB, WuC). | Fair | Pitch pine, Virginia pine, black oak | Pitch pine, Virginia pine |
| Group 10 (RwE) | Poor | Pitch pine, Virginia pine, black oak | Pitch pine, Virginia pine |
| Group 11 (MaB, MaD, MlB, MlD, OaB2, OeB, OeD, OvB, OvD). | Good | Red oak, sugar maple, tulip-poplar, white pine. | Larch, white pine, Austrian pine, Norway spruce. |
| Group 12 (MlF, OeF) | Fair | Red oak, sugar maple, white pine, tulip-poplar. | Larch, white pine, Austrian pine, Norway spruce. |
| Group 13 (MsB2, MtB, MtC, VcA, VcB2, VuB, VuD). | Good | Red oak, sugar maple, tulip-poplar, white pine. | White pine, white spruce, larch |
| Group 14 (DeB, DeD, DsB, DsD). | Poor | Pitch pine, chestnut oak, Virginia pine | Virginia pine |
| Group 15 (DeF, DsF) | Poor | Pitch pine, chestnut oak, Virginia pine | Virginia pine |
| Group 16 (At, NoA, NrB, TsA, TtA). | Poor | Red maple, white pine, hemlock | White pine |
| Group 17 (Mu, Pe, Ps, Rv, Sc, SmD, SsF). | (2) | (2) | (2) |

[1] Ratings are explained in the text.
[2] Too variable to be rated.

to 64 at age 50 years is rated *fair*, and the expected yield is about 6,300 board feet per acre. A site index for oak of 54 or less at age 50 years is rated *poor*, and the expected yield is less than 3,250 board feet per acre.

*Suitable species.*—Listed under "Suitable species" in table 2 are the native trees to favor in managing existing stands and the kinds of trees best suited to planting.

*Seedling mortality.*—Seedling mortality refers to the loss of naturally occurring or planted tree seedlings resulting from unfavorable characteristics of the soils. The rating is *slight* if no more than 25 percent of the planted seedlings are likely to die, and satisfactory restocking from the initial planting can be expected. Adequate restocking ordinarily results from natural regeneration. A rating of *moderate* indicates that between 25 and 50 percent of planted seedlings are likely to die, and some replanting is ordinarily needed. Natural regeneration cannot always be relied upon for adequate and early restocking. A rating of *severe* indicates that more than 50 percent of planted seedlings are likely to die, and special preparation of the seedbed, superior planting techniques, and considerable replanting are needed for adequate and immediate restocking. Restocking cannot be expected to result from natural regeneration if the rating for seedling mortality is *severe.*

*Plant competition.*—Plant competition refers to the rate at which brush, grass, and undesirable trees are likely to invade the different kinds of soil. Plant competition is *slight* if unwanted plants do not prevent adequate natural regeneration and early growth or interfere with adequate development of planted seedlings. It is *moderate* if competing plants delay natural or artificial regeneration, both establishment and growth, but do not prevent the natural development of a fully stocked normal stand. Competition is *severe* if adequate natural or artificial regeneration can be obtained only by intensive site preparation and maintenance, including weeding.

*Equipment limitations.*—Ratings in the column showing equipment limitations are based on the characteristics of the soils and topographic features that restrict or prohibit the use of equipment for harvesting trees or planting seedlings. Steepness of slope, stoniness, and wetness are the principal soil limitations that restrict the use of equipment. The rating is *slight* if there are few limitations. It is *moderate* if some problems exist, such as stones and boulders, moderately steep slopes, or wetness of the soil part of the year. The rating is *severe* if prolonged wetness of the soil, steepness, or stoniness severely limit the use of equipment. If the rating is severe, track-type equipment is best for general use, and winches or similar special equipment are needed for some kinds of work.

*and hazards of woodland suitability groups*

| Seedling mortality | Plant competition | Equipment limitations | Erosion hazard | Windthrow hazard |
|---|---|---|---|---|
| Slight | Severe | Slight | Slight | Slight. |
| Moderate | Moderate | Slight to moderate | Slight to moderate | Slight. |
| Slight | Severe | Moderate | Slight | Slight to moderate. |
| Moderate | Severe | Severe | Slight | Severe. |
| Severe | Severe | Severe | Slight | Severe. |
| Slight | Severe | Moderate | Slight to moderate | Slight to moderate. |
| Slight | Severe | Slight to moderate | Slight to moderate | Slight. |
| Moderate | Severe | Severe | Slight to moderate | Moderate to severe. |
| Moderate | Moderate | Slight to moderate | Slight to moderate | Slight. |
| Moderate | Moderate | Severe | Severe | Slight. |
| Slight | Severe | Slight to moderate | Slight to moderate | Slight. |
| Slight | Severe | Severe | Severe | Slight |
| Slight | Severe | Moderate | Slight to moderate | Slight to moderate. |
| Severe | Slight | Slight to moderate | Slight to moderate | Slight. |
| Severe | Slight | Severe | Severe | Slight. |
| Severe | Severe | Severe | Slight to moderate | Severe. |
| (2) | (2) | (2) | (2) | (2). |

*Erosion hazard.*—Hazard of erosion refers to the risk of erosion. The ratings indicate the amount or intensity of practices required to reduce or control erosion on soils of the different groups. A rating of *slight* indicates that the risk of erosion is low when wood products are harvested, and that few if any practices are needed to control erosion. A rating of *moderate* indicates that erosion control measures are needed on skid and logging roads immediately after wood products are harvested. If the rating is *severe*, it means that erosion, especially gullying, is a severe hazard when wood products are harvested. Harvesting and other operations should be done across the slope as much as possible. Skid trails and logging roads should be laid out on as low grades as possible, and water-disposal systems should be carefully maintained during logging. Erosion control measures are needed on logging roads and skid trails immediately after logging.

*Windthrow hazard.*—The ratings for windthrow hazard represent an evaluation of the factors that control the development of tree roots and consequently the likelihood that trees will be uprooted by wind. A rating of *slight* indicates that normally no trees are blown down by the wind. A rating of *moderate* indicates that some trees are expected to be blown down during periods of excessive soil wetness and high wind. If the rating is *severe*, many trees are expected to be blown down during periods of soil wetness and moderate or high winds.

The ratings in table 2 are generalized for the soils in each of the groups.

## Use of Soils for Wildlife [3]

Pike County contains 348,800 acres, of which about 320,000 acres, or about 90 percent, is forested. Publicly owned land in the county includes 20,951 acres of State game lands, 8,500 acres of State park lands, and 62,893 acres of State forest lands.

The county has a wide variety and a good population of wildlife. Good hunting for small game, deer, and bear is available throughout the county. The four tracts of State game land and most of the State forest land are open to public hunting.

Largely as a result of the present land use, forest game species make up most of the wildlife. Some pheasants and quail are stocked, but the land use and the climate do not favor them, and no natural reproduction of those species occurs.

In table 3 the soils are rated according to their suitability for eight elements of wildlife habitat and three groups of wildlife. Four land types have variable characteristics and have not been rated, although they furnish some food and cover for wildlife. These are Riverwash (Rv), Stony and cobbly alluvial land (Sc), Stony land, moderately steep (SmD), and Stony land, steep (SsF). The elements of wildlife habitat are described in the paragraphs that follow.

*Grain and seed crops* are domestic grains or seed-producing annual herbaceous plants that are planted to produce food for wildlife. Examples are corn, sorghums, wheat, millet, buckwheat, soybeans, and sunflowers.

*Grasses and legumes* are domestic perennial grasses and herbaceous legumes that are planted to furnish cover and food for wildlife. Examples are fescue, brome, bluegrass, timothy, redtop, orchardgrass, reed canarygrass, clover, trefoil, alfalfa, and sericea lespedeza.

*Wild herbaceous upland plants* are native or introduced perennial grasses or forbs (weeds) that provide food and cover principally for upland wildlife and are mainly established through natural processes. Examples are ragweed, wheatgrass, wild rye, oatgrass, pokeweed, strawberries, beggarweed, goldenrod, and dandelion.

*Hardwood woody plants* are deciduous trees, shrubs and woody vines that produce fruit, nuts, buds, catkins, twigs, or foliage that are used extensively as food by wildlife and that commonly are established through natural processes but also may be planted. Examples are oak, beech, cherry, hawthorn, dogwood, viburnum, holly, maple, birch, poplar, grape, honeysuckle, blueberry, and greenbrier, raspberry, rose, and other kinds of briers.

*Coniferous woody plants* are cone-bearing trees and shrubs that are important to wildlife, primarily as cover, but that also furnish food in the form of browse, seeds, or cones. These trees and shrubs are commonly established naturally, but they also may be planted. Examples are pine, spruce, white-cedar, hemlock, fir, redcedar, juniper, and yew.

*Wetland food and cover plants* are annual and perennial, wild, herbaceous plants of moist to wet sites that produce food or cover used mainly by wetland forms of wildlife. They do not include submerged or floating aquatic plants. Examples of wetland food plants are smartweed, wild millet, bulrushes, sedges, wild rice, switchgrass, reed canarygrass, and cattails.

*Shallow water developments* are impoundments or excavations for control of water that generally do not exceed 5 feet in depth. Examples are low dikes and levees, shallow dug-out areas, level ditches, and devices for control of the water level in marshy streams or channels.

*Excavated ponds* are dug-out areas or combinations of dug-out areas and low dikes that hold water of suitable quality, of suitable depth, and in ample supply for the production of fish or wildlife. Such a pond should have a surface area of at least one-quarter of an acre and an average depth of 6 feet throughout at least a quarter of the area. It is also necessary to have a dependable, high water table or another source of unpolluted water of low acidity.

Based on the suitability of the soils for each of the eight habitat elements listed above, the soils are rated according to their suitability for producing three major kinds of wildlife. These ratings indicate only potential suitability. Changes in land use may change the site conditions greatly and thus bring about changes in the species of wildlife. Soils cannot be rated for their ability to produce certain species of wildlife, because climatic and other factors prevent such a rating. It is possible, however, to rate soils according to their ability to produce a given type of vegetation or of wildlife habitat. An abundance of game or a high population of wildlife indicates a good habitat; but a good habitat does not always have a high population of wildlife.

The three major groups of wildlife are described next.

[3] CLAYTON L. HEINEY, wildlife biologist, Soil Conservation Service, assisted in writing this section.

TABLE 3.—*Suitability of soils for elements of wildlife habitat and for kinds of wildlife*

[Figure 1 denotes well suited; 2, suited: 3, poorly suited; and 4, not suited]

| Map symbol | Soil | Elements of wildlife habitat | | | | | | | | Kinds of wildlife | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Grain and seed crops | Grasses and legumes | Wild herbaceous upland plants | Hardwood woody plants | Coniferous woody plants | Wetland food and cover plants | Shallow water developments | Excavated ponds | Openland wildlife | Woodland wildlife | Wetland wildlife |
| At | Atherton loam | 4 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 |
| BrA | Braceville gravelly loam, 0 to 3 percent slopes | 2 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 1 | 1 | 3 |
| BrB2 | Braceville gravelly loam, 3 to 8 percent slopes, moderately eroded | 2 | 1 | 1 | 1 | 3 | 4 | 4 | 4 | 1 | 1 | 4 |
| CaB2 | Cattaraugus channery sandy loam, 3 to 12 percent slopes, moderately eroded | 2 | 1 | 1 | 1 | 3 | 4 | 4 | 4 | 1 | 1 | 4 |
| CaC2 | Cattaraugus channery sandy loam, 12 to 20 percent slopes, moderately eroded | 3 | 2 | 1 | 1 | 3 | 4 | 4 | 4 | 2 | 2 | 4 |
| CeB | Cattaraugus extremely stony sandy loam, 0 to 12 percent slopes | 4 | 4 | 3 | 3 | 1 | 4 | 4 | 4 | 4 | 3 | 4 |
| CeD | Cattaraugus extremely stony sandy loam, 12 to 30 percent slopes | 4 | 4 | 3 | 3 | 1 | 4 | 4 | 4 | 4 | 3 | 4 |
| CgB | Cattaraugus very stony sandy loam, 0 to 12 percent slopes | 4 | 3 | 1 | 1 | 3 | 4 | 4 | 4 | 3 | 2 | 4 |
| CgD | Cattaraugus very stony sandy loam, 12 to 30 percent slopes | 4 | 3 | 1 | 1 | 3 | 4 | 4 | 4 | 3 | 2 | 4 |
| ChB | Chenango cobbly sandy loam, 3 to 12 percent slopes | 2 | 1 | 2 | 2 | 2 | 4 | 4 | 4 | 1 | 2 | 4 |
| ChC | Chenango cobbly sandy loam, 12 to 20 percent slopes | 3 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 2 | 2 | 4 |
| ChD | Chenango cobbly sandy loam, 20 to 30 percent slopes | 4 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 2 | 2 | 4 |
| ClA | Chenango gravelly loam, 0 to 3 percent slopes | 1 | 1 | 1 | 1 | 3 | 4 | 4 | 4 | 1 | 1 | 4 |
| ClB2 | Chenango gravelly loam, 3 to 12 percent slopes, moderately eroded | 2 | 1 | 1 | 1 | 3 | 4 | 4 | 4 | 1 | 1 | 4 |
| CmB | Chenango gravelly sandy loam, 0 to 12 percent slopes | 2 | 1 | 2 | 2 | 3 | 4 | 4 | 4 | 1 | 2 | 4 |
| CmC | Chenango gravelly sandy loam, 12 to 20 percent slopes | 3 | 2 | 2 | 2 | 3 | 4 | 4 | 4 | 2 | 2 | 4 |
| CmD | Chenango gravelly sandy loam, 20 to 30 percent slopes | 4 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 2 | 2 | 4 |
| CnB2 | Culvers channery loam, 2 to 8 percent slopes, moderately eroded | 2 | 1 | 1 | 1 | 3 | 4 | 4 | 4 | 1 | 1 | 4 |
| CnC2 | Culvers channery loam, 8 to 15 percent slopes, moderately eroded | 2 | 1 | 1 | 1 | 3 | 4 | 4 | 4 | 1 | 1 | 4 |
| CuB | Culvers extremely stony loam, 0 to 8 percent slopes | 4 | 4 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CuD | Culvers extremely stony loam, 8 to 25 percent slopes | 4 | 4 | 1 | 1 | 3 | 4 | 4 | 4 | 3 | 2 | 4 |
| CvB | Culvers very stony loam, 0 to 8 percent slopes | 4 | 3 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CvC | Culvers very stony loam, 8 to 25 percent slopes | 4 | 3 | 1 | 1 | 3 | 4 | 4 | 4 | 3 | 2 | 4 |
| DeB | Dekalb extremely stony sandy loam, 0 to 12 percent slopes | 4 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 4 |
| DeD | Dekalb extremely stony sandy loam, 12 to 30 percent slopes | 4 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 4 |
| DeF | Dekalb extremely stony sandy loam, 30 to 80 percent slopes | 4 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 4 |
| DsB | Dekalb-Swartswood very stony sandy loams, 0 to 12 percent slopes | 4 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 4 |
| DsD | Dekalb-Swartswood very stony sandy loams, 12 to 30 percent slopes | 4 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 4 |
| DsF | Dekalb-Swartswood very stony sandy loams, 30 to 80 percent slopes | 4 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 4 |
| Ho | Holly silt loam | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 4 | 2 | 1 | 2 |
| MaB | Manlius rocky silt loam, 0 to 12 percent slopes | 4 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 4 |
| MaD | Manlius rocky silt loam, 12 to 30 percent slopes | 4 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 4 |
| MlB | Manlius very rocky silt loam, 0 to 12 percent slopes | 3 | 3 | 2 | 2 | 2 | 4 | 4 | 4 | 2 | 2 | 4 |

TABLE 3.—*Suitability of soils for elements of wildlife habitat and for kinds of wildlife*—Continued

| Map symbol | Soil | Elements of wildlife habitat: Grain and seed crops | Grasses and legumes | Wild herbaceous upland plants | Hardwood woody plants | Coniferous woody plants | Wetland food and cover plants | Shallow water developments | Excavated ponds | Kinds of wildlife: Openland wildlife | Woodland wildlife | Wetland wildlife |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MlD | Manlius very rocky silt loam, 12 to 30 percent slopes | 3 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 2 | 2 | 4 |
| MlF | Manlius very rocky silt loam, 30 to 80 percent slopes | 4 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 4 |
| MnB2 | Mardin channery silt loam, 2 to 8 percent slopes, moderately eroded | 2 | 1 | 1 | 1 | 3 | 4 | 4 | 3 | 1 | 1 | 4 |
| MnC2 | Mardin channery silt loam, 8 to 15 percent slopes, moderately eroded | 2 | 1 | 1 | 1 | 3 | 4 | 4 | 4 | 1 | 1 | 4 |
| MoB | Mardin very stony loam, 0 to 8 percent slopes | 4 | 3 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| MoC | Mardin very stony loam, 8 to 25 percent slopes | 4 | 3 | 1 | 1 | 3 | 4 | 4 | 4 | 3 | 2 | 4 |
| Mr | Middlebury loam | 2 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 1 | 1 | 3 |
| MsB2 | Morris channery loam, 3 to 8 percent slopes, moderately eroded | 3 | 3 | 2 | 2 | 2 | 3 | 4 | 2 | 3 | 2 | 4 |
| MtB | Morris very stony loam, 0 to 8 percent slopes | 4 | 3 | 2 | 2 | 2 | 3 | 4 | 4 | 3 | 2 | 4 |
| MtC | Morris very stony loam, 8 to 15 percent slopes | 4 | 3 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 2 | 4 |
| Mu | Muck | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 | 4 | 4 | 1 |
| NoA | Norwich channery silt loam, 0 to 3 percent slopes | 4 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 |
| NrB | Norwich very stony silt loam, 0 to 8 percent slopes | 4 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 |
| OaB2 | Oquaga channery loam, 3 to 12 percent slopes, moderately eroded | 3 | 3 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 2 | 4 |
| OeB | Oquaga extremely stony loam, 0 to 12 percent slopes | 4 | 4 | 3 | 3 | 1 | 4 | 4 | 4 | 4 | 3 | 4 |
| OeD | Oquaga extremely stony loam, 12 to 30 percent slopes | 4 | 4 | 3 | 3 | 1 | 4 | 4 | 4 | 4 | 3 | 4 |
| OeF | Oquaga extremely stony loam, 30 to 80 percent slopes | 4 | 4 | 3 | 3 | 1 | 4 | 4 | 4 | 4 | 3 | 4 |
| OvB | Oquaga very stony loam, 0 to 12 percent slopes | 4 | 3 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 2 | 4 |
| OvD | Oquaga very stony loam, 12 to 30 percent slopes | 4 | 3 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 2 | 4 |
| Pa | Papakating silt loam | 4 | 3 | 3 | 1 | 1 | 1 | 2 | 4 | 3 | 1 | 3 |
| Pe | Peat | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 | 4 | 4 | 1 |
| Ps | Peat, shallow | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 | 4 | 4 | 1 |
| Rh | Red Hook loam | 3 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 |
| RwE | Rushtown very shaly silt loam, 25 to 45 percent slopes | 4 | 4 | 3 | 3 | 1 | 4 | 4 | 4 | 4 | 2 | 4 |
| StB2 | Swartswood channery sandy loam, 3 to 12 percent slopes, moderately eroded | 2 | 1 | 1 | 1 | 3 | 4 | 4 | 4 | 1 | 1 | 4 |
| StC2 | Swartswood channery sandy loam, 12 to 20 percent slopes, moderately eroded | 3 | 2 | 1 | 1 | 3 | 4 | 4 | 4 | 2 | 2 | 4 |
| SwB | Swartswood very stony sandy loam, 0 to 12 percent slopes | 4 | 3 | 1 | 1 | 3 | 4 | 4 | 4 | 3 | 2 | [illegible] |
| SwD | Swartswood very stony sandy loam, 12 to 30 percent slopes | 4 | 3 | 1 | 1 | 3 | 4 | 4 | 4 | 3 | 2 | 4 |
| Ta | Tioga loamy fine sand | 2 | 2 | 2 | 1 | 3 | 4 | 4 | 4 | 2 | 2 | 4 |
| TgA | Tioga loamy fine sand, high bottom, 0 to 3 percent slopes | 2 | 2 | 2 | 1 | 3 | 4 | 4 | 4 | 2 | 2 | 4 |
| TgB | Tioga loamy fine sand, high bottom, 3 to 12 percent slopes | 2 | 2 | 2 | 1 | 3 | 4 | 4 | 4 | 2 | 2 | 4 |
| To | Tioga silt loam | 1 | 1 | 1 | 1 | 3 | 4 | 4 | 4 | 1 | 1 | 4 |
| TsA | Tughill channery silt loam, 0 to 3 percent slopes | 4 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 |
| TtA | Tughill very stony loam, 0 to 3 percent slopes | 4 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 3 | 1 | 1 |
| TuB | Tunkhannock gravelly sandy loam, 3 to 12 percent slopes | 2 | 1 | 1 | 1 | 3 | 4 | 4 | 4 | 1 | 1 | 4 |
| TuC | Tunkhannock gravelly sandy loam, 12 to 20 percent slopes | 3 | 2 | 1 | 1 | 3 | 4 | 4 | 4 | 2 | 1 | 4 |

TABLE 3.—*Suitability of soils for elements of wildlife habitat and for kinds of wildlife*—Continued

| Map symbol | Soil | Elements of wildlife habitat | | | | | | | | Kinds of wildlife | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Grain and seed crops | Grasses and legumes | Wild herbaceous upland plants | Hardwood woody plants | Coniferous woody plants | Wetland food and cover plants | Shallow water developments | Excavated ponds | Openland wildlife | Woodland wildlife | Wetland wildlife |
| TuD | Tunkhannock gravelly sandy loam, 20 to 30 percent slopes | 4 | 2 | 1 | 1 | 3 | 4 | 4 | 4 | 2 | 2 | 4 |
| VcA | Volusia channery loam, 0 to 3 percent slopes | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 |
| VcB2 | Volusia channery loam, 3 to 8 percent slopes, moderately eroded | 3 | 3 | 2 | 2 | 2 | 3 | 4 | 4 | 3 | 2 | 4 |
| VuB | Volusia very stony silt loam, 0 to 8 percent slopes | 4 | 3 | 2 | 2 | 2 | 3 | 4 | 4 | 3 | 2 | 4 |
| VuD | Volusia very stony silt loam, 8 to 25 percent slopes | 4 | 3 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 2 | 4 |
| WuB | Wurtsboro very stony sandy loam, 0 to 8 percent slopes | 4 | 3 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| WuC | Wurtsboro very stony sandy loam, 8 to 25 percent slopes | 4 | 3 | 1 | 1 | 3 | 4 | 4 | 4 | 3 | 2 | 4 |

*Openland wildlife* consists of birds and mammals that are commonly found in such open places as cropped fields, meadows, pastures, and nonforested overgrown fields. Among these birds and mammals are bobwhite quail, ring-necked pheasants, mourning doves, woodcock, cottontail rabbits, meadow larks, killdeer, and field sparrows.

*Woodland wildlife* consists of birds and mammals that are commonly found in wooded areas. Examples are ruffed grouse, wild turkeys, deer, squirrels, raccoon, wood thrushes, warblers, and vireos.

*Wetland wildlife* consists of birds and mammals that are commonly found in marshes and swamps. Examples are ducks, geese, heron, snipe, rails, coots, muskrat, mink, and beaver.

All the soils in the county are suitable for producing some kinds of wildlife. Wildlife is an important byproduct of nearly all the land that is used for field crops, pastures, or forests.

Many practices that are used primarily to improve and conserve the soils also benefit wildlife. Contour stripcropping and crop rotation provide a mixture of cover and increase the amount of food and cover that wildlife can use. During winter, cover crops and crop residues are used by wildlife for food and cover. Diversion terraces and grassed waterways provide travel lanes and nesting places. Fertilizing and liming increase the amount of food and cover for wildlife.

Some practices can be applied especially to encourage wildlife. Plantings of grasses and legumes along field borders provide nesting places and food. If hedgerows are planted they furnish travel lanes, food, and cover. Small patches of corn, small grain, and buckwheat that are planted to supply food for wildlife are particularly valuable in abandoned or idle areas, especially if these patches are located near good cover or between wooded areas and open fields.

Habitats for wetland wildlife can be made or improved by digging ponds in pastures or, for shallow water impoundments, by installing special structures for water control in marshy areas. The ponds can be stocked with fish, and they are also used by migratory waterfowl as resting places. If shrubs and trees are planted around ponds, they attract many other kinds of wildlife. Shallow impoundments are breeding grounds and feeding areas for waterfowl and shorebirds. Muskrat, mink, and other furbearers also benefit from these developments.

The greatest danger to fish in the waters of the county is from pollution by chemical wastes, sewage, and sediment resulting from erosion. Fish can be killed by industrial waste, sewage, insecticides, and herbicides. Sediment from soil erosion is particularly damaging: As sediment is washed into rivers and streams, it settles and covers spawning beds and recently hatched fish. The sediment destroys food organisms and food-producing areas. By filling pools, sediment causes the temperature of the water to rise to a point that is harmful to fish. Erosion of streambanks furnishes part of the harmful sediment. Commonly part of the streambank erosion is caused by overgrazing, which should be controlled. The streambanks can also be protected by plantings. Protecting the streambank, however, is not enough. The entire watershed should be protected by carrying out complete conservation plans that protect every farm and all of the land in the watershed.

## Engineering Uses of the Soils

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, and sewage-disposal systems. Soil properties most important to the engineer are permeability to water, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size and distribution, plasticity, and acidity. Depth to a seasonal high water table and depth to bedrock are also important.

This soil survey of Pike County contains information that can be used by engineers to—

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the soil properties that are important in planning agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, pipelines, and airports and in planning detailed investigations at the intended locations.
4. Locate potential sources of sand, gravel, and other construction material.
5. Correlate pavement performance to types of soil to develop information that will be useful in designing future roads and maintaining present roads.
6. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps, reports, and aerial photographs to make maps and reports that can be used by engineers.
8. Estimate the nature of the material to be encountered when excavating for buildings and other structures.
9. Determine the suitability of soils as sites for the infiltration of waste from septic tanks.

With the use of the soil map for identification, the engineering interpretations in this section can be useful for many purposes. It should be emphasized that they may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some of the terms used by soil scientists may not be familiar to the engineer, and some words, for example, soil, clay, silt, and sand, may have special meanings in soil science. These and other special terms that are used are defined in the Glossary in the back of this survey.

### *Engineering classification systems*

Most highway engineers classify soil material in accordance with the system approved by the American Association of State Highway Officials (AASHO) (*1*). In this system soil materials are classified in seven principal groups. The groups range from A–1, which consists of gravelly soils of high bearing capacity, to A–7, which consists of clay soils having low strength when wet. Within each group the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best material to 20 for the poorest. The group index number is shown in parenthesis following the symbol that gives the AASHO classification in the table of engineering test data, table 4.

Some engineers prefer to use the Unified soil classification system (*18*). In this system soil materials are identified as coarse grained, eight classes; fine grained, six classes; and highly organic materials.

TABLE 4.—*Engineering*

[Tests performed by the Pennsylvania Department of Highways in accordance with

| Soil name and location | Parent material | Pennsylvania report number | Depth | Horizon | Moisture-density data [1]: Maximum dry density | Moisture-density data [1]: Optimum moisture |
|---|---|---|---|---|---|---|
| | | | *Inches* | | *Lb. per cu. ft.* | *Percent* |
| Chenango cobbly sandy loam: | | | | | | |
| Porter Township: Fivemile Meadow Road in Camp Hatfield, 50 feet W. of gravel pit (Modal profile). | Wisconsin glacial outwash. | BM–17238<br>BM–17239 | 6–11<br>29–48 | B21<br>IIB24 | 114<br>128 | 15<br>10 |
| Dingman Township: 600 feet NE. of entrance to Rock Hill Reservation on Dingman Pike (Finer textured than modal profile). | Glacial till; some water sorting in the C horizon. | BM–23659<br>BM–23660 | 12–25<br>38–60 | B2<br>C | 121<br>126 | 12<br>10 |
| Porter Township: 100 feet NE. of Camp Hatfield on Dry Meadow Road in Edgemere State Forest (Coarser textured than modal profile). | Glacial till; some water sorting in the C horizon. | BM–23657<br>BM–23658 | 15–33<br>46–72 | B2<br>C2 | 133<br>138 | 9<br>8 |
| Chenango gravelly loam: | | | | | | |
| Porter Township: 0.5 mile S. of Flat Ridge Road on Old Broadhead Trail and 90 feet W. on a kame (Modal profile). | Wisconsin glacial outwash. | BM–17232<br>BM–17233 | 9–16<br>26–50 | B22<br>IIB3 | 128<br>123 | 10<br>13 |

See footnotes at end of table.

### *Engineering properties and engineering interpretations*

The properties of the soils and the interpretations that are most significant to engineering are presented in tables 4, 5, and 6. Additional information helpful to engineers can be obtained from the detailed soil map and the general soil map. For some information, however, it may be necessary to refer to other parts of the survey, particularly to the section "Descriptions of The Soils."

### *Engineering test data*

Table 4 gives engineering test data for soil profiles that were sampled as representative of eight important soil series in Pike County. The samples represent modal profiles and variations from modal profiles of soils in these series. Tests were made by the Pennsylvania Department of Highways Soil Testing Laboratories, Harrisburg, Pa.

The engineering classifications in tables 4 and 5 are based on data obtained by mechanical analyses and by tests to determine the liquid limit and the plastic limit. The mechanical analyses were made by combined sieve and hydrometer methods. Percentages of clay obtained by the hydrometer method should not be used in naming textural classes and soil types in the USDA system of soil classification.

The tests for liquid limit and plastic limit measure the effect of water on the consistence of soil material. As the moisture content of a clayey soil is increased from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from the plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

Table 4 also gives compaction (moisture-density) data for the tested soils. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that, the density decreases with further increase in the moisture content. The maximum density is reported as maximum dry density in pounds per cubic foot, and the optimum moisture content is reported in percent.

### *Estimated engineering properties*

Table 5 lists the soils of Pike County and their estimated engineering properties. The properties are those of a typical soil of each series, and they are shown for the layers that are significant to engineering. Where test data are available, the average values from table 4 are shown. If tests were not performed, the estimates shown are based on test data obtained from similar soils in this county or other counties and by experience in engineering construction. Since the estimates cover only the typical soils, considerable variation from these values should be anticipated. More information on the range of properties of the soils can be obtained in other sections of this publication.

The map symbols and the names of the soil series are listed alphabetically in table 5. Depth to a seasonal high

*test data*

standard procedures of the American Association of State Highway Officials (AASHO)]

| Mechanical analysis [2] | | | | | | | | | | | Liquid limit | Plasticity index | Classification [3] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Material larger than 3 inches discarded in laboratory | Percentage passing sieve— | | | | | | Percentage smaller than— | | | | | | AASHO [4] | Unified [5] |
| | 3-in. | ¾-in. | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 40 (0.42 mm.) | No. 200 (0.074 mm.) | 0.05 mm. | 0.02 mm. | 0.005 mm. | 0.002 mm. | | | | |
| *Percent* | | | | | | | | | | | *Percent* | | | |
| 10 | 100 | 73 | 52 | 44 | 37 | 29 | 28 | 22 | 12 | 8 | 31 | 3 | A-2-4(0) | GM |
| 31 | 100 | 83 | 59 | 41 | 12 | 3 | 3 | 2 | 2 | 1 | [6] NP | [6] NP | A-1-a(0) | SP |
| ---------- | 100 | 95 | 88 | 86 | 81 | 43 | 39 | 30 | 17 | 12 | 19 | NP | A-4(2) | SM |
| ---------- | 100 | 68 | 53 | 51 | 45 | 20 | 18 | 11 | 8 | 6 | NP | NP | A-1-b(0) | GM |
| ---------- | 100 | 83 | 59 | 41 | 8 | 4 | 4 | 3 | 2 | 2 | 18 | NP | A-1-a(0) | SP |
| 24 | 100 | 63 | 40 | 28 | 7 | 1 | 1 | .8 | .6 | .5 | NP | NP | A-1-a(0) | GP |
| ---------- | 100 | 94 | 68 | 58 | 38 | 18 | 17 | 13 | 8 | 6 | 20 | NP | A-1-b(0) | SM |
| 20 | 100 | 63 | 47 | 39 | 8 | 2 | 2 | 1 | .2 | .1 | NP | NP | A-1-a(0) | GP |

TABLE 4.—*Engineering*

| Soil name and location | Parent material | Pennsylvania report number | Depth | Horizon | Moisture-density data [1] | |
|---|---|---|---|---|---|---|
| | | | | | Maximum dry density | Optimum moisture |
| | | | *Inches* | | *Lb. per cu. ft.* | *Percent* |
| Chenango gravelly sandy loam: | | | | | | |
| Delaware Township: 500 feet S. of Conashaugh Creek on U.S. 209 (Modal profile). | Alluvial sediments from Chemung and Catskill formations. | BM–23665 | 6–17 | B2 | 120 | 10 |
| | | BM–24120 | 17–48 | C | 119 | 14 |
| Gravel pit 1 mile N. of Mill Rift (Finer textured than modal profile). | Alluvial sand and gravel from Chemung and Catskill formations. | BM–23663 | 8–25 | B1 | 125 | 12 |
| | | BM–23664 | 25–72 | C | 114 | 13 |
| Westfall Township: 2 miles NE. of Milford and ⅛ mile E. of U.S. 6 (Coarser textured than modal profile). | Alluvial sand and gravel from Chemung and Catskill formations. | BM–23661 | 7–22 | B2 | 129 | 10 |
| | | BM–23662 | 28–72 | C | 116 | 13 |
| Culvers very stony loam: | | | | | | |
| Lackawaxen Township: 0.5 mile N. of U.S. 6, W. of Greeley, on T. 417 (Modal profile). | Glacial till from local Chemung and Catskill shales. | BM–24127 | 7–15 | A'2g | 120 | 13 |
| | | BM–24128 | 32–60 | B'x2 | 123 | 11 |
| Blooming Grove Township: 2 miles SE. of Lords Valley (Finer textured than modal profile). | Glacial till from local Chemung and Catskill shales. | BM–24131 | 8–18 | A'2g | 124 | 11 |
| | | BM–24132 | 36–60 | B'x2 | 129 | 10 |
| Palmyra Township: On Rt. 507 (Coarser textured than modal profile). | Glacial till from local Chemung shale. | BM–24129 | 7–26 | Bl | 122 | 11 |
| | | BM–24130 | 42–72 | Bx2 | 127 | 10 |
| Manlius very rocky silt loam: | | | | | | |
| Delaware Township: 500 feet SE. of Rt. 51005, along stone fence (Coarser textured than modal profile). | Devonian siltstone and shale. | BM–17234 | 6–15 | B2 | 118 | 14 |
| | | BM–17235 | 23–30 | C | 128 | 11 |
| Delaware Township: SE. angle of T. 362 and USGS benchmark, then 580 feet E. along stone fence (Modal profile). | Devonian siltstone and shale. | BM–23651 | 8–19 | B2 | 115 | 14 |
| | | BM–23652 | 25–30 | C | 129 | 9 |
| Dingman Township: 0.5 mile N. of intersection of T. 362 and T. 339 (Shallower and finer textured than modal profile). | Glacially scraped siltstone and shale. | BM–24149 | 10–15 | Bl | 120 | 12 |
| | | BM–24150 | 15–20 | C | 114 | 14 |
| Porter Township: 1.5 miles N. of Hemlock Lake (Finer textured than modal profile). | Glacially scraped siltstone and shale. | BM–24147 | 12–18 | Bl | 112 | 16 |
| | | BM–24148 | 18–36 | C | 109 | 17 |
| Morris very stony loam: | | | | | | |
| Palmyra Township: 0.6 mile N. of Rt. 51032 on Rt. 390 W. of Blooming Grove (Modal profile). | Glacial till of local shale and sandstone from Catskill and Chemung formations. | BM–24133 | 15–42 | B'xl | 118 | 14 |
| | | BM–24134 | 42–60 | B'x2 | 122 | 13 |
| Greene Township: Intersection T. 372 and T. 378 (Finer textured than modal profile). | Fluvioglacial till of shale and sandstone. | BM–24135 | 0–8 | A1 | 98 | 21 |
| | | BM–24136 | 18–30 | Bx1 | 121 | 12 |
| Greene Township: 200 feet E. of Wilson Swamp Pond on Rt. 390 (Coarser textured than modal profile). | Glacial till of local sandstone and shale from Catskill and Chemung formations. | BM–24137 | 10–20 | B2 | 124 | 10 |
| | | BM–24138 | 20–42 | Bx | 128 | 10 |

See footnotes at end of table.

*test data*—Continued

| Mechanical analysis [2] | | | | | | | | | | | Liquid limit | Plasticity index | Classification [3] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Material larger than 3 inches discarded in laboratory | Percentage passing sieve— | | | | | | Percentage smaller than— | | | | | | AASHO [4] | Unified [5] |
| | 3-in. | ¾-in. | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 40 (0.42 mm.) | No. 200 (0.074 mm.) | 0. 05 mm. | 0. 02 mm. | 0. 005 mm. | 0. 002 mm. | | | | |
| *Percent* | | | | | | | | | | | *Percent* | | | |
| ---------- | ------ | 100 | 99 | 99 | 95 | 32 | 27 | 18 | 9 | 8 | NP | NP | A-2-4(0) | SM |
| ---------- | 100 | 66 | 57 | 54 | 17 | 4 | 4 | 3 | 2 | 2 | NP | NP | A-1-b(0) | SP |
| ---------- | ------ | ------ | 100 | 97 | 50 | 16 | 15 | 11 | 9 | 7 | NP | NP | A-1-b(0) | SM |
| ---------- | ------ | ------ | 100 | 98 | 52 | 3 | 3 | 2 | 1 | 1 | NP | NP | A-3(0) | SP |
| ---------- | 100 | 86 | 72 | 67 | 57 | 22 | 20 | 15 | 10 | 7 | NP | NP | A-2-4(0) | SM |
| ---------- | ------ | 100 | 99 | 98 | 65 | 9 | 8 | 6 | 5 | 5 | NP | NP | A-3(0) | SP-SM |
| ---------- | 100 | 95 | 87 | 83 | 75 | 52 | 48 | 38 | 22 | 14 | 26 | 3 | A-4(3) | ML |
| ---------- | 100 | 92 | 81 | 77 | 68 | 46 | 43 | 34 | 20 | 14 | 21 | 2 | A-4(2) | SM |
| ---------- | 100 | 96 | 92 | 90 | 85 | 53 | 48 | 35 | 18 | 12 | 19 | NP | A-4(4) | ML |
| ---------- | 100 | 97 | 90 | 86 | 77 | 39 | 36 | 27 | 19 | 14 | 18 | 2 | A-4(1) | SM |
| ---------- | 100 | 94 | 89 | 87 | 82 | 50 | 41 | 24 | 13 | 10 | 17 | NP | A-4(3) | SM |
| ---------- | 100 | 95 | 86 | 82 | 76 | 47 | 42 | 22 | 14 | 10 | 17 | NP | A-4(2) | SM |
| 21 | 100 | 74 | 43 | 35 | 29 | 26 | 25 | 17 | 9 | 6 | 30 | 5 | A-2-4(0) | GM |
| 12 | 100 | 67 | 44 | 35 | 26 | 21 | 20 | 14 | 5 | 3 | 23 | NP | A-1-b(0) | GM |
| 15 | 100 | 65 | 46 | 40 | 35 | 30 | 29 | 22 | 11 | 8 | 28 | 5 | A-2-4(0) | [7] GM-GC |
| 23 | 100 | 57 | 33 | 25 | 17 | 11 | 10 | 7 | 4 | 3 | 21 | NP | A-1-a(0) | GW-GM |
| ---------- | 100 | 87 | 68 | 61 | 55 | 44 | 41 | 30 | 15 | 10 | 24 | 2 | A-4(2) | GM |
| ---------- | 100 | 69 | 45 | 39 | 34 | 28 | 26 | 20 | 9 | 6 | 27 | 2 | A-2-4(0) | GM |
| ---------- | ------ | 100 | 94 | 92 | 88 | 66 | 63 | 44 | 22 | 17 | 29 | 4 | A-4(6) | ML |
| ---------- | 100 | 55 | 43 | 41 | 37 | 27 | 26 | 19 | 10 | 6 | 31 | 3 | A-2-4(0) | GM |
| ---------- | 100 | 98 | 91 | 89 | 84 | 58 | 55 | 43 | 27 | 18 | 26 | 5 | A-4(5) | ML-CL |
| ---------- | ------ | 96 | 83 | 79 | 73 | 56 | 54 | 44 | 27 | 21 | 27 | 7 | A-4(4) | ML-CL |
| ---------- | 100 | 88 | 85 | 85 | 30 | 56 | 54 | 43 | 22 | 12 | 40 | 3 | A-4(4) | ML |
| ---------- | 100 | 95 | 93 | 82 | 78 | 50 | 47 | 35 | 20 | 14 | 22 | 2 | A-4(3) | SM |
| ---------- | ------ | 100 | 96 | 94 | 84 | 36 | 31 | 20 | 10 | 7 | NP | NP | A-4(0) | SM |
| ---------- | 100 | 97 | 90 | 87 | 78 | 36 | 32 | 22 | 11 | 8 | NP | NP | A-4(0) | SM |

TABLE 4—*Engineering*

| Soil name and location | Parent material | Pennsylvania report number | Depth | Horizon | Moisture-density data [1] Maximum dry density | Optimum moisture |
|---|---|---|---|---|---|---|
| | | | *Inches* | | *Lb. per cu. ft.* | *Percent* |
| Swartswood very stony sandy loam: | | | | | | |
| Porter Township: 0.5 mile S. of Porter Lake Road and 105 feet E. of Woods Road on Standing Stone Trail (Modal profile). | Wisconsin glacial till. | BM-17228<br>BM-17229 | 8–15<br>34–44 | B21<br>Bx31 | 120<br>128 | 12<br>9 |
| Porter Township: ⅛ mile N. of Old Broadhead Road on Flat Ridge Road (Coarser textured than modal profile). | Wisconsin glacial till. | BM-29819<br>BM-23650 | 12–18<br>37–58 | B22<br>Bx2 | 125<br>126 | 10<br>9 |
| Dingman Township: 1.6 miles S. of Dingman Pike and 100 feet W. of Dry Meadow Road (Shallower and finer textured than modal profile). | Sandy Wisconsin glacial till. | BM-17242<br>BM-17243 | 8–14<br>35–45 | B23<br>Cx1 | 123<br>128 | 11<br>9 |
| Porter Township: 3.95 miles S. of Dingman Pike and 50 feet SW. of Fivemile Meadow Road (Shallower and coarser textured than modal profile). | Sandy Wisconsin glacial till. | BM-17240<br>BM-17241 | 5–9<br>30–37 | B22<br>Cx1 | 118<br>130 | 14<br>9 |
| Blooming Grove Township: 1 mile N. of Lords Valley Golf Course (Finer textured than modal profile). | Shallow Late Wisconsin glacial till. | BM-24139<br>BM-24140 | 1–17<br>36–48 | B1<br>IIC | 127<br>122 | 10<br>12 |
| Tioga loamy fine sand: | | | | | | |
| Delaware Township: 1,066 feet E. of U.S. 209, along farm lane (Modal profile). | Alluvium from glaciated sandstone and shale. | BM-23653<br>BM-23654 | 28–35<br>84–94 | C6<br>C10 | 118<br>124 | 11<br>9 |
| Westfall Township: E. end of Rose Lane, Matamoras (Coarser textured than modal profile). | Alluvium from glaciated sandstone and shale. | BM-24151<br>BM-24152 | 8–20<br>20–40 | AC<br>C1 | 107<br>113 | 15<br>14 |
| Dingman Township: 100 feet N. of the Raymond Kill (Finer textured than modal profile). | Alluvial sediments from Chemung and Catskill formations. | BM-24143<br>BM-24144 | 8–18<br>18–32 | C1<br>C2 | 108<br>107 | 16<br>18 |
| Tunkhannock gravelly sandy loam: | | | | | | |
| Lackawaxen Township: 200 feet SE. of Kimbles (Modal profile). | Alluvial sediments on a stream terrace. | BM-24121<br>BM-24122 | 6–18<br>28–72 | B2<br>C | 119<br>119 | 9<br>10 |
| Blooming Grove Township: 1 mile NW. of Blooming Grove (Finer textured than modal profile). | Glacial outwash. | BM-24125<br>BM-24126 | 5–19<br>32–72 | B2<br>C | 129<br>133 | 10<br>9 |
| Greene Township: 1.5 miles N. of Greentown (Coarser textured than modal profile). | Alluvial sediments on a stream terrace. | BM-24123<br>BM-24124 | 16–32<br>32–84 | B22<br>C | 134<br>120 | 9<br>11 |
| Wurtsboro very stony sandy loam: | | | | | | |
| Porter Township: 0.8 mile S. of Porter Lake Road on Standing Stone Trail (Modal profile). | Wisconsin glacial till. | BM-17230<br>BM-17231 | 11–15<br>36–48 | B22<br>Bx3 | 123<br>127 | 12<br>10 |
| Lehman Township: 0.5 mile S. of Lake Maskenozha on Rt. 51003 (Coarser textured than modal profile). | Glacial till of siltstone and sandstone from Chemung formation. | BM-24141<br>BM-24142 | 18–34<br>50–70 | Bx1<br>Bx3 | 125<br>124 | 12<br>12 |
| Porter Township: Pecks Pond, 500 feet W. of the entrance to Hemlock Farms (Finer textured than modal profile). | Glacial till of local siltstone and sandstone from Chemung formation. | BM-24145<br>BM-24146 | 10–18<br>28–42 | B2<br>Bx2 | 122<br>124 | 10<br>11 |

[1] Based on "Moisture-Density Relations of Soils Using a 5.5-lb. Rammer and 12-in. Drop," AASHO Designation T 99–57, Method A (*1*).

[2] Mechanical analyses according to the AASHO Designation T 88–57 (*1*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

*test data*—Continued

| Mechanical analysis [2] | | | | | | | | | | | Liquid limit | Plasticity index | Classification [3] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Material larger than 3 inches discarded in laboratory | Percentage passing sieve— | | | | | | Percentage smaller than— | | | | | | AASHO [4] | Unified [5] |
| | 3-in. | ¾-in. | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 40 (0.42 mm.) | No. 200 (0.074 mm.) | 0.05 mm. | 0.02 mm. | 0.005 mm. | 0.002 mm. | | | | |
| *Percent* | | | | | | | | | | | *Percent* | | | |
| ------ | 100 | 94 | 78 | 72 | 67 | 42 | 39 | 29 | 13 | 9 | 21 | NP | A-4(1) | SM |
| 19 | 100 | 90 | 79 | 73 | 62 | 32 | 29 | 21 | 10 | 6 | 14 | NP | A-2-4(0) | SM |
| ------ | 100 | 97 | 82 | 73 | 63 | 36 | 33 | 22 | 11 | 8 | 16 | NP | A-4(0) | SM |
| ------ | 100 | 70 | 58 | 53 | 44 | 22 | 18 | 12 | 5 | 3 | NP | NP | A-1-b(0) | GM |
| ------ | 100 | 95 | 83 | 77 | 69 | 41 | 38 | 28 | 14 | 8 | 18 | NP | A-4(1) | SM |
| 7 | 100 | 89 | 80 | 76 | 67 | 40 | 37 | 27 | 13 | 8 | 15 | NP | A-4(1) | SM |
| ------ | 100 | 89 | 73 | 68 | 60 | 42 | 40 | 32 | 19 | 13 | 25 | 2 | A-4(1) | SM |
| ------ | 100 | 98 | 79 | 70 | 57 | 34 | 32 | 23 | 10 | 8 | 14 | NP | A-2-4(0) | SM |
| ------ | 100 | 90 | 79 | 75 | 68 | 41 | 38 | 29 | 16 | 10 | 17 | NP | A-4(1) | SM |
| ------ | ------ | 100 | 98 | 97 | 86 | 44 | 41 | 32 | 21 | 16 | 22 | 1 | A-4(2) | SM |
| ------ | ------ | ------ | ------ | ------ | 100 | 56 | 45 | 26 | 10 | 7 | NP | NP | A-4(4) | ML |
| ------ | ------ | ------ | ------ | 100 | 89 | 40 | 34 | 22 | 10 | 7 | NP | NP | A-4(1) | SM |
| ------ | ------ | ------ | ------ | 100 | 89 | 11 | 9 | 6 | 6 | 4 | NP | NP | A-2-4(0) | SP-SM |
| ------ | ------ | ------ | ------ | 100 | 91 | 13 | 11 | 9 | 8 | 6 | NP | NP | A-2-4(0) | SM |
| ------ | ------ | ------ | ------ | ------ | 100 | 84 | 80 | 58 | 26 | 13 | 28 | 1 | A-4(8) | ML |
| ------ | ------ | ------ | ------ | ------ | 100 | 92 | 87 | 63 | 25 | 16 | 31 | 3 | A-4(8) | ML |
| ------ | ------ | 100 | 94 | 90 | 85 | 29 | 23 | 13 | 7 | 4 | NP | NP | A-2-4(0) | SM |
| ------ | 100 | 97 | 90 | 89 | 86 | 36 | 29 | 18 | 9 | 7 | NP | NP | A-4(0) | SM |
| ------ | 100 | 86 | 60 | 46 | 33 | 23 | 22 | 15 | 9 | 7 | 25 | 3 | A-1-b(0) | GM |
| ------ | 100 | 89 | 64 | 44 | 15 | 5 | 4 | 3 | 2 | 2 | NP | NP | A-1-a(0) | SW-SM |
| ------ | 100 | 75 | 57 | 48 | 33 | 13 | 12 | 9 | 6 | 4 | NP | NP | A-1-b(0) | SM |
| ------ | ------ | 100 | 94 | 91 | 87 | 45 | 36 | 23 | 12 | 8 | NP | NP | A-4(2) | SM |
| ------ | 100 | 99 | 90 | 82 | 72 | 46 | 43 | 30 | 14 | 8 | 20 | NP | A-4(2) | SM |
| ------ | ------ | 91 | 81 | 76 | 68 | 45 | 41 | 30 | 15 | 10 | 16 | NP | A-4(2) | SM |
| ------ | 100 | 79 | 61 | 53 | 41 | 31 | 29 | 25 | 15 | 11 | 29 | 4 | A-2-4(0) | GM |
| ------ | 100 | 90 | 71 | 60 | 44 | 30 | 28 | 22 | 13 | 10 | 25 | 2 | A-2-4(0) | SM |
| ------ | 100 | 96 | 90 | 86 | 78 | 45 | 42 | 30 | 14 | 10 | 18 | NP | A-4(2) | SM |
| ------ | 100 | 99 | 92 | 87 | 79 | 47 | 44 | 30 | 18 | 12 | 20 | 1 | A-4(2) | SM |

[3] Classifications based on material smaller than 3 inches.

[4] Based on "Standard Specifications for Highway Materials and Methods of Sampling and Testing" (Pt. 1, Ed. 8): "The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes," AASHO Designation M 145-49 (*1*).

[5] Based on the "Unified Soil Classification System," Technical Memorandum No. 3-357, Volume 1, Waterways Experiment Station, Corps of Engineers, March 1953 (*18*).

[6] NP = Nonplastic.

[7] Soil Conservation Service and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within 2 points from A-line are to be given a borderline classification.

TABLE 5.—*Estimated engineering*

[Absence of data indicates that an estimate was not made. Four land types are too variable to permit reliable

| Soil series and map symbols | Depth to— | | Depth from surface | Coarse fraction greater than 3 inches | Percentage passing sieve— | | | | Engineering classification | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Seasonal high water table | Bedrock | | | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 40 (0.42 mm.) | No. 200 (0.074 mm.) | Unified | AASHO |
| | *Feet* | *Feet* | *Inches* | *Percent* | | | | | | |
| Atherton (At) | 0–½ | 3+ | 0–12 | | 75–90 | 70–80 | 65–75 | 55–65 | OL, ML | A–4, A–6 |
| | | | 12–42 | | 70–80 | 60–75 | 50–60 | 40–50 | SM, SC | A–4, A–6 |
| Braceville (BrA, BrB2) | 1½–3 | 3+ | 0–7 | | | | | | | |
| | | | 7–30 | | 60–70 | 50–60 | 45–55 | 30–40 | SM, GM | A–2, A–4 |
| | | | 30–42 | | 50–60 | 45–55 | 20–30 | 15–25 | SM | A–1 |
| Cattaraugus (CaB2, CaC2, CeB, CeD, CgB, CgD). | 6+ | 3+ | 0–8 | | | | | | | |
| | | | 8–16 | 10 | 55–65 | 50–60 | 40–50 | 30–40 | GM | A–2, A–4 |
| | | | 16–72 | 25 | 65–75 | 55–65 | 45–55 | 35–45 | GM, SM | A–4 |
| Chenango (ChB, ChC, ChD, ClA, ClB2, CmB, CmC, CmD). | 4+ | 8+ | 0–9 | | | | | | | |
| | | | 9–16 | 2 | 50–70 | 40–50 | 20–30 | 5–40 | GM, GP, SM | A–1, A–2, A–4 |
| | | | 16–50 | 5 | 40–60 | 25–50 | 5–45 | 0–15 | GP, SM | A–1, A–2 |
| Culvers (CnB2, CnC2, CuB, CuD, CvB, CvC). | 1½–2½ | 8+ | 0–7 | | | | | | | |
| | | | 7–15 | | 70–80 | 60–70 | 50–60 | 40–55 | ML, GM | A–4, A–6 |
| | | | 15–72 | | 80–90 | 70–80 | 55–70 | 40–50 | ML, SM | A–4, A–6 |
| Dekalb (DeB, DeD, DeF, DsB, DsD, DsF). (For Swartswood parts of DsB, DsD, and DsF see the Swartswood series). | 4–6 | 2–4 | 0–9 | | | | | | | |
| | | | 9–28 | 25 | 70–80 | 65–75 | 50–60 | 25–35 | SM | A–2 |
| | | | 28–42 | 50 | 55–65 | 50–60 | 35–45 | 25–35 | SC, GM | A–2 |
| Holly (Ho) | 0–½ | 3+ | 0–7 | | | | | | | |
| | | | 7–20 | | 95–100 | 95–100 | 75–100 | 85–100 | ML | A–4, A–6 |
| | | | 20–42 | | 85–95 | 80–90 | 75–85 | 70–80 | ML | A–4, A–6 |
| Manlius (MaB, MaD, MlB, MlD, MlF). | 3+ | 1½–3½ | 0–8 | | | | | | | |
| | | | 8–19 | | 45–70 | 35–60 | 30–55 | 25–45 | SM, GM | A–2, A–4 |
| | | | 19–30 | 0–10 | 35–45 | 25–40 | 15–35 | 15–30 | SM, GM | A–1, A–2 |
| Mardin (MnB2, MnC2, MoB, MoC). | 1½–3 | 3+ | 0–14 | | | | | | | |
| | | | 14–28 | | 60–70 | 55–65 | 50–60 | 35–45 | GM, SM | A–2, A–4 |
| | | | 28–80 | | 70–80 | 65–75 | 60–70 | 40–50 | SM | A–4 |
| Middlebury (Mr) | 1–2½ | 5+ | 0–42 | | 100 | 95–100 | 80–95 | 35–55 | ML, SM | A–4, A–6 |
| Morris (MsB2, MtB, MtC) | ½–2 | 5+ | 0–5 | | | | | | | |
| | | | 5–15 | | 85–95 | 80–90 | 75–80 | 35–60 | ML, SM | A–4 |
| | | | 15–60 | | 85–95 | 80–85 | 70–80 | 35–60 | SM, ML | A–2, A–4 |
| Muck (Mu) | 0 | 3+ | 0–36 | | | | | | Pt | |
| Norwich (NoA, NrB) | 0–1 | 5+ | 0–9 | | | | | | | |
| | | | 9–36 | | 100 | 100 | 95–100 | 80–90 | CL, ML | A–4, A–6 |
| | | | 36–42 | | 90–100 | 90–100 | 90–100 | 65–75 | ML, CL | A–4 |

*properties of the soils*

estimates; these are Riverwash (Rv), Stony and cobbly alluvial land (Sc), and Stony land (SmD and SsF)]

| USDA texture (typical profile) | Permeability | Available moisture capacity | Reaction | Optimum moisture | Maximum dry density | Shrink-swell potential | Corrosion potential (steel) |
|---|---|---|---|---|---|---|---|
| | *Inches per hour* | *Inches per inch* | *pH* | *Percent* | *Pounds per cubic foot* | | |
| Loam | 2.0–6.3 | 0.14–0.20 | 5.0–6.0 | 13 | 115 | Moderate | High. |
| Loam and sandy loam | 0.2–0.63 | 0.10–0.15 | 5.5–6.5 | 13 | 118 | Moderate | High. |
| Gravelly loam | 2.0–6.3 | 0.12–0.18 | 5.5–6.5 | | | | |
| Gravelly loam | 0.2–0.63 | 0.12–0.18 | 5.5–6.0 | 15 | 108 | Low | Moderate. |
| Gravelly silt loam | <0.2 | 0.10–0.15 | 5.5–7.0 | 9 | 128 | Low | Moderate. |
| Sandy loam | 0.63–2.0 | 0.10–0.14 | 4.5–5.0 | | | | |
| Fine sandy loam | 0.63–2.0 | 0.09–0.12 | 4.5–5.0 | 14 | 119 | Low | Moderate. |
| Loam | <0.20 | 0.08–0.10 | 5.0–5.6 | 11 | 123 | Low | Low. |
| Gravelly loam and gravelly sandy loam. | 2.0–6.3 | 0.10–0.16 | 3.9–4.9 | | | | |
| Gravelly sandy loam | 2.0–6.3 | 0.07–0.13 | 4.5–6.0 | 11 | 120 | Low | Low. |
| Very gravelly sandy loam | >6.3 | 0.03–0.10 | 4.5–5.5 | 9 | 120 | Low | Low. |
| Very stony loam | 2.0–6.3 | 0.15–0.20 | 4.5–5.0 | | | | |
| Loam | 2.0–6.3 | 0.13–0.18 | 4.5–5.0 | 11 | 122 | Low | Moderate. |
| Channery loam | <0.2 | 0.08–0.12 | 5.0–5.5 | 10 | 127 | Low | Moderate. |
| Sandy loam | 2.0–6.3 | 0.11–0.19 | 4.5–5.0 | | | | |
| Loam | 2.0–6.3 | 0.11–0.12 | 5.0–5.5 | 10 | 123 | Low | Low. |
| Sandy loam | 2.0–6.3 | 0.08–0.12 | 4.5–5.0 | 10 | 123 | Low | Low. |
| Silt loam | 0.63–2.0 | 0.15–0.20 | 5.0–6.0 | | | | |
| Silt loam | 0.63–2.0 | 0.12–0.18 | 5.5–6.0 | 16 | 107 | Moderate | High. |
| Loam | <0.2 | 0.10–0.15 | 5.0–6.0 | 17 | 105 | Low | High. |
| Shaly silt loam | 0.63–2.0 | 0.10–0.20 | 4.2–4.4 | | | | |
| Very shaly silt loam | 0.63–6.3 | 0.12–0.18 | 4.4 | 13 | 117 | Low | Low. |
| Very shaly silt loam | 0.63–2.0 | 0.10–0.16 | 4.8 | 11 | 120 | Low | Low. |
| Very stony loam | 2.0–6.3 | 0.17–0.20 | 5.0–5.4 | | | | |
| Channery loam and silt loam | 0.63–2.0 | 0.14–0.20 | 5.2–5.4 | 13 | 120 | Low | Low. |
| Channery loam | <0.2 | 0.05–0.10 | 5.6–6.0 | 12 | 123 | Low | High. |
| Loam | 2.0–6.3 | 0.15–0.20 | 5.2–5.4 | 15 | 110 | Low | High. |
| Loam | 2.0–6.3 | 0.15–0.20 | 4.8 | | | | |
| Loam | 0.63–2.0 | 0.12–0.18 | 4.6–4.8 | 15 | 118 | Low | High. |
| Loam | <0.20 | 0.08–0.12 | 5.4–5.6 | 12 | 123 | Low | High. |
| | | | 4.2–4.4 | | | Medium | High. |
| Silt loam | 0.63–2.0 | 0.16–0.22 | 5.8 | | | | |
| Silt loam | 0.20–0.63 | 0.12–0.18 | 5.6–5.8 | 17 | 106 | Low | High. |
| Loam | 0.20–0.63 | 0.05–0.10 | 6.0 | 13 | 117 | Low | High. |

TABLE 5.—*Estimated engineering*

| Soil series and map symbols | Depth to— Seasonal high water table | Depth to— Bedrock | Depth from surface | Coarse fraction greater than 3 inches | Percentage passing sieve— No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 40 (0.42 mm.) | No. 200 (0.074 mm.) | Engineering classification Unified | AASHO |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Feet* | *Feet* | *Inches* | *Percent* | | | | | | |
| Oquaga (OaB2, OeB, OeD, OeF, OvB, OvD). | 4–6 | 2–3½ | 0–16 | -------- | -------- | -------- | -------- | -------- | -------- | -------- |
| | | | 16–28 | -------- | 50–60 | 45–55 | 30–50 | 25–45 | GM | A–1, A–2, A–4. |
| | | | 28–40 | -------- | 45–55 | 34–55 | 25–35 | 20–30 | GM | A–1, A–2 |
| Papakating (Pa) | 0 | 3+ | 0–18 | -------- | 100 | 100 | 90–100 | 85–95 | ML | A–4 |
| | | | 18–42 | -------- | 100 | 100 | 95–100 | 80–90 | ML, CL | A–4, A–6 |
| Peat (Pe, Ps) | 0 | 2+ | 0–60 | -------- | -------- | -------- | -------- | -------- | Pt | -------- |
| Red Hook (Rh) | ½–1½ | 3+ | 0–7 | -------- | -------- | -------- | -------- | -------- | -------- | -------- |
| | | | 7–18 | 5–10 | 70–80 | 60–70 | 50–60 | 50–60 | ML | A–4 |
| | | | 18–36 | 5–15 | 50–60 | 35–45 | 20–30 | 10–20 | SM, GM–GP | A–1, A–2 |
| Rushtown (RwE) | 6+ | 3+ | 0–72 | <5 | 35–45 | 30–40 | 25–35 | 15–25 | GM | A–1 |
| Swartswood (StB2, StC2, SwB, SwD). | 3+ | 3½+ | 0–5 | -------- | -------- | -------- | -------- | -------- | -------- | -------- |
| | | | 5–30 | -------- | 70–80 | 65–75 | 60–70 | 20–30 | SM | A–2 |
| | | | 30–60 | -------- | 60–70 | 50–60 | 45–55 | 15–25 | SM | A–2 |
| Tioga: | | | | | | | | | | |
| Loamy fine sand (Ta, TgA, TgB). | 6+ | 5+ | 0–13 | -------- | 100 | 100 | 100 | 40–55 | SM, ML | A–4 |
| | | | 13–154 | -------- | 100 | 100 | 95 | 40–70 | ML, SM | A–4 |
| Silt loam (To) | 6+ | 5+ | 0–12 | -------- | 80–90 | 70–80 | 60–70 | 40–60 | ML, SM | A–4 |
| | | | 12–50 | -------- | 80–90 | 70–80 | 65–75 | 30–40 | SM | A–2, A–4 |
| Tughill (TsA, TtA) | 0 | 5+ | 0–9 | -------- | -------- | -------- | -------- | -------- | -------- | -------- |
| | | | 9–18 | -------- | 70–90 | 60–80 | 60–80 | 50–60 | ML | A–4 |
| | | | 18–42 | -------- | 70–90 | 60–80 | 60–80 | 45–60 | ML, SM | A–4 |
| Tunkhannock (TuB, TuC, TuD). | 6+ | 5+ | 0–6 | -------- | -------- | -------- | -------- | -------- | -------- | -------- |
| | | | 6–18 | 2 | 55–70 | 45–60 | 30–40 | 5–10 | SM–SP | A–1, A–2 |
| | | | 18–72 | 5 | 60–70 | 45–60 | 15–25 | 5–10 | SM–SP | A–1 |
| Volusia (VcA, VcB2, VuB, VuD). | 0–1½ | 5+ | 0–7 | -------- | -------- | -------- | -------- | -------- | -------- | -------- |
| | | | 7–14 | -------- | 60–80 | 60–70 | 55–65 | 40–50 | SM, GM | A–4, A–6 |
| | | | 14–42 | -------- | 60–70 | 55–65 | 50–60 | 35–45 | GM | A–4, A–6 |
| Wurtsboro (WuB, WuC) | 1½–3 | 4+ | 0–5 | -------- | -------- | -------- | -------- | -------- | -------- | -------- |
| | | | 5–20 | -------- | 70–90 | 65–85 | 55–75 | 30–50 | SM | A–2, A–4 |
| | | | 20–56 | -------- | 70–90 | 70–85 | 60–70 | 30–50 | SM | A–2, A–4 |

*properties of the soils*—Continued

| USDA texture (typical profile) | Permeability | Available moisture capacity | Reaction | Optimum moisture | Maximum dry density | Shrink-swell potential | Corrosion potential (steel) |
|---|---|---|---|---|---|---|---|
| | *Inches per hour* | *Inches per inch* | *pH* | *Percent* | *Pounds per cubic foot* | | |
| Loam | 2. 0–6. 3 | 0. 13–0. 16 | 4. 5–5. 5 | | | | |
| Loam | 2. 0–6. 3 | 0. 13–0. 16 | 4. 5–5. 5 | 10 | 130 | Low | Low. |
| Loam | 2. 0–6. 3 | 0. 05–0. 10 | 5. 0 | 10 | 127 | Low | Low. |
| Silt loam | 0. 63–2. 0 | 0. 16–0. 22 | 5. 0–6. 0 | 14 | 105 | Moderate | High. |
| Silty clay loam | <0. 20 | 0. 14–0. 20 | 4. 5–5. 5 | 16 | 95 | Moderate | High. |
| | | | | | | Low | High. |
| Loam | 0. 63–2. 0 | 0. 14–0. 18 | 5. 5–6. 0 | | | | |
| Loam | <0. 20 | 0. 14–0. 16 | 5. 0–5. 5 | 12 | 110 | Moderate | High. |
| Gravelly loam | 0. 63–2. 0 | 0. 05–0. 10 | 5. 0 | 10 | 120 | Low | High. |
| Very shaly silt loam and shale fragments. | >6. 3 | 0. 05–0. 12 | 5. 0 | | 108 | Low | Low. |
| Fine sandy loam | 2. 0–6. 3 | 0. 16–0. 19 | 4. 0–5. 0 | | | | |
| Gravelly sandy loam | 2. 0–6. 3 | 0. 08–0. 14 | 4. 0–5. 0 | 12 | 120 | Low | Moderate. |
| Gravelly fine sandy loam | 0. 63–2. 0 | 0. 05–0. 10 | 4. 0–5. 0 | 10 | 128 | Low | Low. |
| Loamy fine sand | 2. 0–6. 3 | 0. 08–0. 12 | 5. 0–6. 0 | 11 | 117 | Low | Low. |
| Fine sandy loam, loamy sand and sand. | >6. 3 | 0. 08–0. 15 | 5. 0–6. 0 | 11 | 117 | Low | Low. |
| Silt loam | 0. 63–2. 0 | 0. 17–0. 20 | 5. 0–6. 0 | 14 | 110 | Low | Moderate. |
| Gravelly loam | 0. 63–2. 0 | 0. 14–0. 20 | 5. 0–6. 0 | 13 | 110 | Low | Moderate. |
| Loam | 0. 63–2. 0 | 0. 18–0. 22 | 4. 5–5. 5 | | | | |
| Loam | 0. 63–2. 0 | 0. 15–0. 19 | 5. 0–5. 5 | 12 | 120 | Low | High. |
| Loam | <0. 20 | 0. 08–0. 14 | 5. 5–6. 0 | 12 | 120 | Low | High. |
| Gravelly sandy loam | 2. 0–6. 3 | 0. 13–0. 15 | 4. 5–5. 5 | | | | |
| Gravelly loam | 2. 0–6. 3 | 0. 13–0. 15 | 4. 5–5. 5 | 10 | 128 | Low | Low. |
| Very gravelly sandy loam and loamy sand. | >6. 3 | 0. 05–0. 10 | 4. 4–4. 6 | 10 | 125 | Low | Low. |
| Loam | 0. 63–2. 0 | 0. 18–0. 20 | 5. 0–5. 5 | | | | |
| Gravelly loam | 0. 63–2. 0 | 0. 14–0. 18 | 5. 0–5. 5 | 13 | 119 | Low | High. |
| Loam | <0. 20 | 0. 12–0. 16 | 5. 5–6. 0 | 10 | 119 | Low | High. |
| Loam and gravelly sandy loam | 0. 63–2. 0 | 0. 16–0. 20 | 3. 0–5. 0 | | | | |
| Gravelly loam | 0. 63–2. 0 | 0. 14–0. 18 | 4. 0–5. 0 | 11 | 120 | Moderate | Moderate. |
| Gravelly sandy loam and gravelly loam. | <0. 20 | 0. 10–0. 12 | 4. 0–5. 0 | 10 | 125 | Low | Moderate. |

TABLE 6.—*Engineering*

[Four land types are too variable to be rated. They are Riverwash (Rv), Stony

| Soil series and map symbols | Suitability for winter grading | Susceptibility to frost action | Suitability as a source of— | | | Soil features affecting engineering practices for— | |
|---|---|---|---|---|---|---|---|
| | | | Topsoil | Sand and gravel | Road fill | Highway location | Construction and maintenance of pipelines |
| Atherton (At) | Poor | High | Fair | Poor | Fair | High water table. | High water table; high corrosivity. |
| Braceville (BrA, BrB2) | Fair | Moderate | Poor | Good | Good | Seasonal high water table. | Seasonal high water table. |
| Cattaraugus (CaB2, CaC2, CeB, CeD, CgB, CgD). | Good | Moderate | Fair to poor | Poor | Good | Subject to sloughing in deep cuts. | Stoniness in places. |
| Chenango (ChB, ChC, ChD, ClA, ClB2, CmB, CmC, CmD). | Good | Low | Poor | Good | Good | No unfavorable features. | No unfavorable features. |
| Culvers (CnB2, CnC2, CuB, CuD, CvB, CvC). | Fair | Moderate | Fair; poor in stony soils. | Poor | Good | Seasonal high water table. | Seasonal high water table; moderate corrosivity. |
| Dekalb (DeB, DeD, DeF, DsB, DsD, DsF). (For Swartswood parts of DsB, DsD, and DsF, see the Swartswood series). | Good | Low | Poor | Poor | Good; limited quantity. | Depth 2 to 4 feet to bedrock. | Depth 2 to 4 feet to bedrock. |
| Holly (Ho) | Poor | High | Fair | Unsuitable | Fair | Flooding; high water table. | Flooding; high water table. |
| Manlius (MaB, MaD, MlB, MlD, MlF). | Fair | Moderate | Poor | Unsuitable | Fair | Depth 1½ to 3½ feet to bedrock. | Hard bedrock at 1½ to 3½ feet. |
| Mardin (MnB2, MnC2, MoB, MoC). | Fair | Moderate | Fair | Unsuitable. | Good | Seasonal high water table. | Seasonal high water table. |
| Middlebury (Mr) | Poor | High | Fair | Unsuitable. | Fair | Flooding; seasonal high water table. | Flooding; seasonal high water table. |
| Morris (MsB2, MtB, MtC). | Poor | High | Fair to poor. | Unsuitable. | Fair | High water table; seepage on top of fragipan. | High water table. |
| Muck (Mu) | Unsuitable. | High | Good for mulch. | Unsuitable. | Unsuitable. | High water table; very poor bearing capacity; subsidence. | High water table; subsidence. |
| Norwich (NoA, NrB) | Unsuitable. | High | Poor | Unsuitable. | Poor | High water table. | High water table. |

*interpretations of the soils*

and cobbly alluvial land (Sc), and Stony lands (SmD and SsF)]

| Soil features affecting engineering practices for—Continued | | | | |
|---|---|---|---|---|
| Impoundments | | Agricultural drainage | Irrigation | Terraces or waterways |
| Reservoir area | Embankment | | | |
| Rapid permeability in substratum; high water table. | Pervious | Outlets difficult to obtain. | High water table | Not applicable. |
| Rapid permeability in substratum. | Stable | Slow permeability | Slow permeability; seasonal high water table. | Seasonal high water table. |
| Slow permeability | Impervious when compacted. | Not generally needed; slow permeability. | Slow permeability | Slow permeability. |
| Rapid permeability | Excessive seepage | Not needed | Low available moisture capacity. | Difficult to establish sod because of gravel and droughtiness. |
| Bedrock may contain open joints. | Stoniness in places; low seepage where compacted. | Slow permeability in fragipan. | Slow permeability; seasonal high water table. | Seepage on top of fragipan. |
| Rapid permeability; depth 2 to 4 feet to bedrock. | Permeable material | Not needed | Low available moisture capacity. | Stoniness; depth 2 to 4 feet to bedrock. |
| Subject to flooding; gravel lenses in substratum are rapidly permeable. | Poor stability; high water table. | Slow permeability; outlets difficult to locate. | High water table | Flooding; high water table. |
| Depth 1½ to 3½ feet to bedrock. | Fair stability; pervious material. | Not needed | Low available moisture capacity. | Depth 1½ to 3½ feet to rock; low available moisture capacity. |
| Bedrock may be jointed. | Fairly stable; stony in places. | Slow permeability | Seasonal high water table; slow permeability. | Seepage on top of fragipan. |
| Rapid permeability in substratum. | Stable after selective placement. | Subject to flooding; outlets difficult to locate. | Seasonal high water table. | Not applicable. |
| Slow permeability | Fairly stable; stony in places. | Slow permeability in fragipan. | Seasonal high water table; slow permeability. | High water table; seepage on top of fragipan. |
| Variable stability; rapid permeability. | Shrinks; difficult to compact. | Lack of outlets; subsidence. | High water table | Generally not applicable. |
| High water table | Poor stability; difficult to compact. | Slow permeability in fragipan. | High water table | Seepage on top of fragipan. |

TABLE 6.—*Engineering*

| Soil series and map symbols | Suitability for winter grading | Suscepti-bility to frost action | Suitability as a source of— | | | Soil features affecting engineering practices for— | |
|---|---|---|---|---|---|---|---|
| | | | Topsoil | Sand and gravel | Road fill | Highway location | Construction and maintenance of pipelines |
| Oquaga (OaB2, OeB, OeD, OeF, OvB, OvD). | Good | Moderate | Poor | Unsuit-able. | Good; limited quantity. | Depth 2 to 3½ feet to bed-rock. | Depth 2 to 3½ feet to hard bedrock. |
| Papakating (Pa) | Poor | High | Fair | Unsuit-able. | Fair | Subject to flooding; high water table. | Subject to flooding; high water table. |
| Peat (Pe, Ps) | Poor | High | Poor | Unsuit-able. | Unsuit-able. | Very poor bear-ing capacity; subsidence; high water table. | Poor bearing capacity; high water table. |
| Red Hook (Rh) | Poor | High | Fair | Poor | Fair | Seasonal high water table. | Seasonal high water table. |
| Rushtown (RwE) | Good | Low | Poor | Poor | Good | Cut slopes slough; difficult to revegetate. | Possible sloughing. |
| Swartswood (StB2, StC2, SwB, SwD). | Good | Moderate | Fair; poor on sandy soils. | Unsuitable | Good | Subject to sloughing in deep cuts. | Subject to sloughing. |
| Tioga (Ta, TgA, TgB, To) | Fair | Moderate | Fair | Good | Poor | Ocassional flooding. | Occasional flooding. |
| Tughill (TsA, TtA) | Unsuitable | High | Poor | Unsuitable | Fair | High water table. | High water table. |
| Tunkhannock (TuB, TuC, TuD). | Good | Low | Poor | Good | Good | No unfavorable features. | No unfavorable features. |
| Volusia (VcA, VcB2, VuB, VuD). | Poor | High | Fair | Unsuitable | Fair | High water table. | High water table. |
| Wurtsboro (WuB, WuC) | Poor | Moderate | Good | Unsuitable | Fair | Seasonal high water table. | Seasonal high water table. |

*interpretations of the soils*—Continued

| Soil features affecting engineering practices for—Continued | | | | | |
|---|---|---|---|---|---|
| Impoundments | | Agricultural drainage | Irrigation | Terraces or waterways |
| Reservoir area | Embankment | | | |
| Depth 2 to 3½ feet to bedrock. | Pervious; fairly stable | Not needed | Low moisture-holding capacity. | 2 to 3½ feet to bedrock. |
| Subject to flooding | Difficult to compact; unstable. | Subject to flooding; high water table. | High water table | High water table. |
| Peat floats to surface when flooded; rapid permeability. | Pervious material; unstable. | Lack of outlets | High water table | Generally not applicable. |
| Rapidly permeable substratum. | Pervious substratum material. | Slowly permeable solum | Seasonal high water table; moderate available moisture capacity. | Seasonal high water table. |
| Rapid permeability | Pervious material | Not needed | Low available moisture capacity. | Rapid permeability; few fines. |
| Moderate permeability | Stony in places | Not needed | Moderate available moisture capacity. | Stony in places. |
| Moderate to rapid permeability. | Fairly stable | Not needed | Moderate to high available moisture capacity. | Erodible; droughty. |
| High water table | High water table; difficult to compact. | High water table | High water table | High water table. |
| Rapid permeability | Very pervious material in substratum. | Not needed | Low available moisture capacity. | Rapid permeability; many coarse fragments. |
| High water table; slow permeability. | Slowly permeable when compacted. | Slowly permeable; high water table. | High water table; fragipan. | High water table; fragipan. |
| Slow permeability | Seasonal high water table; stony in places. | Seasonal high water table; slowly permeable fragipan. | Seasonal high water table; fragipan. | Fragipan; stony in places. |

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water table and to bedrock are shown. In the column that shows depth from the surface, the layers indicated are fairly typical of the layers in all the soils of any one series. Estimates of some properties are not given for the upper layer, because the material from this layer is unsuitable for use in many engineering structures. The upper layer at many construction sites can be salvaged and used later as topsoil in which to plant vegetation in selected areas.

The estimated percentage passing the specified sieves, and the classification in the AASHO and the Unified systems, are based on test data if the soils have been tested. For soils of this county that have not been sampled for testing, the estimates are based on test data from similar soils in this county or elsewhere and on experience of engineers and soil scientists.

The estimates of permeability refer to movement of water through the soil in its natural, undisturbed position. The permeability depends largely on the soil texture, porosity, and structure.

The available moisture capacity, expressed in inches per inch of soil depth, is the approximate amount of water available to plants between the field capacity and the wilting point. Factors such as texture, structure, bulk density, and organic-matter content affect this capacity.

The reaction of the soil, expressed in pH, is the degree of acidity or alkalinity of the soil. Some cropped soils that have received large applications of lime for several years are less acid than those listed in table 5.

Shrink-swell potential is an indication of the volume change to be expected with a change in moisture content. It is estimated primarily on the basis of the amount and type of clay present. In general, soils classified as CH and A–7 have a moderate to high shrink-swell potential. Clean sand and gravel, soils that contain small amounts of nonplastic to slightly plastic fines, and most other nonplastic to slightly plastic soil materials have low shrink-swell potential.

### *Interpretation of soil properties for use of soils in engineering*

In table 6 the soils of Pike County are rated according to their suitability and limiting features for engineering uses. The ratings given are for suitability for winter grading; susceptibility to frost action; and suitability as a source of topsoil, sand and gravel, and material for road fill. Soil features that affect several kinds of engineering work are described.

The suitability of soils for winter grading depends largely on the texture of the soil material, the natural content of water, and the depth to the water table during winter. Fine-textured soil material is the least suitable.

The susceptibility of a soil to frost action depends on the texture of the soil and the depth to the water table during the freezing period. Silty soils that have a seasonal high water table have the highest susceptibility.

Suitability of the soil material for road fill depends largely on the texture of the soil and the natural content of water. Fine sands and silty soils are difficult to compact, highly erodible, and less suitable for road fill than coarser sand and gravel.

In appraising features of soils for the vertical alinement of highways, the kinds of soil material, as well as the soil drainage, must be considered. Shallowness to bedrock and the presence of boulders, peat, or muck influence vertical alinement of highways. Flood plains must have special consideration. In Pike County the level of the seasonal high water table is an important factor.

Ice lenses form in a wet soil during winter. The resulting differential volume change may cause displacement of the pavement and the fill. Thawing of the ice in spring removes the support and, as a result, the pavement breaks and shifts. Traffic on the broken pavement then removes the saturated subgrade and fill material by a pumping action and causes further deterioration of the highway.

Ratings given in table 6 for bearing capacity are estimated and should not be used to assign specific values of bearing capacity.

Soil limitations for construction of pipelines are low bearing strength that hinders movement of heavy equipment and hard bedrock at a shallow depth that increases the cost of excavation and of backfilling. A seasonal high water table accelerates corrosion of the pipe. Corrosion is most active along the boundary line between well-drained soils and somewhat poorly drained or poorly drained soils.

Some seepage is normal when water is impounded behind dikes, levees, and pond embankments. Excessive seepage, however, usually causes failure of the structure. Well-graded material, which is material that contains gravel, sand, silt, and clay in more or less equal proportions, can be compacted into a mass that contains minimum pore space and allows minimum seepage.

Soil limitations for reservoir areas of ponds are rapid permeability and shallow depth to bedrock. The stratified sandy and gravelly soils of the terraces, as a rule, do not hold water well enough to be used for ponds.

Wet soils, to be suitable for agricultural drainage, should be permeable and should have enough slope to provide surface drainage. Medium soil texture and blocky structure are favorable for downward movement and lateral movement of water through the soil. The soil should have a root zone of adequate depth after it is drained.

Soils that are suitable for irrigation are well drained, but they contain enough fine material to have favorable moisture-holding capacity. Soils that are most suitable for waterways are not subject to erosion, and they furnish an environment that is favorable for rapid growth of a protective cover of grass.

## Soils in Community Developments

The soil survey contains basic information that is useful in drafting land-use plans for the county or its political subdivisions. The soil maps are published at a scale that is suitable for many aspects of community planning. Interpretive maps can be made from the soil map and the information in tables 6 and 7 to assist in determining limitations of different areas for various uses.

Table 7 was made for the general guidance of planning officials and developers who are concerned with using land and with avoiding mistakes and costly changes in plans. Table 7 will also aid the individual who is looking for a place to live in the county. Although the maps and these tables serve as a guide, and will eliminate some sites from further consideration, they do not supplant direct, detailed, onsite investigation when any development is being planned. In this section the soil features are given major consideration. Not considered are location in relation to

established business centers or transportation lines and other economic factors that are important and often decide the ultimate use of an area. This section gives ratings based on the limitations of soils when they are used for community developments. The ease or difficulty of making improvements is largely controlled by the characteristics of the soils. Table 7 lists all the soils in the county, except Riverwash, Stony and cobbly alluvial land, Stony land, moderately steep, and Stony land, steep, and shows the estimated degree and the major kinds of limitations that affect use for the specified purposes listed. The four land types are not named, because they have too variable characteristics to be rated.

Soil features that are related to community developments and residential uses of land are depth of soil over bedrock, degree of slope, permeability, incidence of flooding, depth to seasonal high water table, soil texture, and degree of stoniness. Limitations of the soils for the specified uses have been rated as *slight*, *moderate*, or *severe*. The most favorable soils have been given a rating of *slight*, because few soils have no limitations in use. A rating of *moderate* indicates soil properties that make necessary special practices to overcome or correct the limitations. A rating of *severe* indicates soil limitations that generally are very difficult to overcome or correct. A rating of severe does not imply that the soil cannot be used for the purpose shown. It does indicate greater limitations or problems than a rating of slight or moderate. If the rating is moderate or severe, the major soil property that causes the problems or limitations is given.

The uses of soils for community developments that are rated in table 7 are discussed in the following paragraphs.

*Onsite disposal of sewage effluent.*—The main limiting features of soils for this use are impeded permeability, steepness of slope, restricted depth to bedrock, and the presence of a seasonal high water table. The soils rated slight generally have few or no limitations that restrict their use as disposal fields. Those rated moderate are likely to be borderline soils and should be investigated carefully at the exact site of the installation. On some of the soils that are rated moderate, drainage fields need to be larger than on those that are rated slight. All the soils that are rated severe should be very carefully investigated to determine if a disposal field can be expected to function adequately. The ratings in table 7 refer to year-round use of the soils. Some of the soils have ratings less severe than those listed in table 7 if the disposal of sewage effluent is needed only for a summer camp or for other part-time use.

*Sewage lagoons.*—The limitations of the soils in this county for sewage lagoons are much the same as those shown for farm ponds that are shown in table 6 in the section "Engineering Uses of The Soils." Among the features that largely control the degree of limitation of sewage lagoons are the incidence of flooding, the permeability of the substratum, the depth to rock, and the degree of slope. In very wet soils excavation may encounter springs or inflow from the ground water. Disposal of the excess water is then required if the site is to be made usable.

*Sites for homes (with basements).*—Table 7 rates the soils as homesites in subdivisions. The ratings are for buildings that are three stories or less in height and that have less than an 8-foot excavacation for basements. Considered in rating the soils are the depth to a seasonal high water table, the depth to and the kind of bedrock, the degree of slope, the hazard of flooding, and the need for shaping the land and for other kinds of landscaping. Flooding is a severe hazard for use of a soil as a homesite.

*Landscaping and development of lawns on homesites.*—It is assumed that enough lime and fertilizer are used for the plants that are grown. The need for these materials, therefore, it not considered in the ratings for this use. Suitable soil material is needed in sufficient amounts so that desirable trees and other plants can survive and grow well. Among the important soil properties that determine whether a good lawn can be established are depth of soil, texture, slope, droughtiness, depth to a seasonal high water table, and the presence of stones or rocks.

*Streets and parking lots in subdivisions.*—Soil requirements and limitations for streets and parking lots in subdivisions are similar to those for highways. Table 5 shows the depth to and the kind of bedrock, the depth to the water table, and the soil texture. Table 6 shows the suitability of each soil in the county for road fill, the limitations that affect location of highways, and the susceptibility to frost action. Other limiting features that affect the use of soils for streets and parking lots are steepness of slope and flooding. Soils that have slopes or more than 8 percent are severely limited for use as parking lots.

*Sanitary land fill.*—A sanitary land fill is an area that is used for the disposal of refuse or garbage. The refuse or garbage is covered with enough material to meet the requirements of sanitation and make a stable fill. The main soil requirement is for enough material to cover the refuse and garbage. If trenches are dug, the depth to underlying rock is especially important. Among features that affect use of soils for land fill are the depth to rock, the incidence of flooding, the presence of a high water table, and the presence of stones or rocks. Esthetic, economic, and sociological factors are important in choosing the site for a sanitary land fill, but they have not been considered in the ratings for this purpose shown in table 7.

*Cemeteries.*—The requirements for a satisfactory cemetery site are an adequate depth of unconsolidated material that is easily excavated, a seasonal water table that is not less than 6 feet deep, and a location not subject to flooding, A stone-free, medium-textured soil is preferred so that lawns and landscaping can be established and maintained with minimum effort.

## Use of Soils for Recreation [4]

Recreation is an important enterprise in Pike County. Taking into account present and predicted trends, recreation may become the major land use in the county. A knowledge of the different soils is essential in selecting sites for various kinds of outdoor recreation.

Table 8 lists the limitations of the soils for seven major kinds of recreational use. Table 6, in the section "Engineering Uses of the Soils," gives information on the features of soils in each soil series that affect the location of highways, the construction of ponds, and other uses. In table 5 estimates are given of the soil properties important in engineering.

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[4] CLAYTON L. HEINEY, wildlife biologist, Soil Conservation Service, assisted in writing this section.

TABLE 7.—*Major limitations that influence use of the soils*

[Four land types are too variable to be rated. These are Riverwash (Rv),

| Soil series and mapping symbols | Estimated degree of limitation for— Disposal of effluent from septic tanks | Sewage lagoons | Homesites of 3 stories or less with basements; subdivisions |
|---|---|---|---|
| Atherton: | | | |
| At | Severe: high water table | Severe: rapid permeability in substratum. | Severe: high water table |
| Braceville: | | | |
| BrA | Severe:[1] seasonal high water table; slow permeability. | Severe:[1] rapid permeability in substratum. | Moderate: seasonal high water table. |
| BrB2 | Severe:[1] seasonal high water table; slow permeability. | Severe:[1] rapid permeability in substratum. | Moderate: seasonal high water table. |
| Cattaraugus: | | | |
| CaB2 | Severe: slow permeability | Moderate: slope | Slight |
| CaC2 | Severe: slope; slow permeability. | Severe: slope too steep | Moderate to severe: slope too steep. |
| CeB | Severe: stoniness; slow permeability. | Moderate: slope; stoniness | Severe: stoniness |
| CeD | Severe: slope too steep | Severe: slope too steep | Severe: slope too steep |
| CgB | Severe: stoniness; slow permeability. | Moderate: slope too steep | Moderate: stoniness |
| CgD | Severe: slope too steep | Severe: slope too steep | Severe: slope too steep |
| Chenango: | | | |
| ChB | Slight to moderate:[1] slope | Severe: rapid permeability | Slight |
| ChC | Moderate to severe:[1] slope | Severe: rapid permeability; slope too steep. | Moderate to severe: slope |
| ChD | Severe: slope too steep | Severe: rapid permeability; slope too steep. | Severe: slope too steep |
| ClA | Slight[1] | Severe: rapid permeability | Slight |
| ClB2 | Slight to moderate:[1] slope | Severe: rapid permeability | Slight |
| CmB | Slight to moderate:[1] slope | Severe: rapid permeability | Slight |
| CmC | Moderate to severe:[1] slope | Severe: rapid permeability; slope too steep. | Moderate to severe: slope |
| CmD | Severe: slope too steep | Severe: rapid permeability; slope too steep. | Severe: slope too steep |
| Culvers: | | | |
| CnB2 | Severe: slow permeability | Moderate: slope | Moderate: seasonal high water table. |
| CnC2 | Severe: slow permeability | Severe: slope too steep | Moderate: seasonal high water table. |
| CuB | Severe: slow permeability | Severe: stoniness | Severe: stoniness |
| CuD | Severe: slow permeability | Severe: slope too steep; stoniness. | Severe: stoniness; slope too steep. |
| CvB | Severe: slow permeability | Moderate: slope | Moderate: stoniness; seasonal high water table. |
| CvC | Severe: slow permeability; slope too steep. | Severe: slope too steep | Moderate to severe: stoniness; slope. |
| Dekalb: | | | |
| DeB | Severe: 2 to 4 feet to bedrock | Severe: rapid permeability; 2 to 4 feet to bedrock. | Severe: stoniness; 2 to 4 feet to bedrock. |
| DeD | Severe: slope too steep; 2 to 4 feet to bedrock. | Severe: rapid permeability; slope too steep. | Severe: slope too steep; 2 to 4 feet to bedrock. |
| DeF | Severe: 2 to 4 feet to bedrock; slope too steep. | Severe: slope too steep | Severe: slope too steep |

See footnotes at end of table.

*for community developments, and estimated degree of limitation*

Stony and cobbly alluvial land (Sc), and Stony lands (SnD and SsF)]

| Estimated degree of limitation for—Continued | | | |
|---|---|---|---|
| Landscaping and lawns at homesites | Streets and parking lots in subdivisions | Sanitary land fill | Cemeteries |
| Severe: high water table | Severe: high water table | Severe: high water table | Severe: high water table. |
| Slight | Moderate: seasonal high water table. | Severe:[1] seasonal high water table; slow permeability. | Moderate: seasonal high water table. |
| Slight | Moderate: seasonal high water table; slope too steep. | Severe:[1] seasonal high water table; slow permeability. | Moderate: seasonal high water table. |
| Moderate: coarse fragments | Moderate: slope | Severe: slow permeability | Severe: slow permeability. |
| Moderate: coarse fragments; slope. | Severe: slope too steep | Severe: slope; slow permeability. | Severe: slope too steep; slow permeability. |
| Severe: stoniness | Moderate: slope; stoniness | Severe: stoniness; slow permeability. | Severe: slow permeability; stoniness. |
| Severe: stoniness | Severe: slope too steep | Severe: stoniness; slow permeability. | Severe: slope too steep; stoniness; slow permeability. |
| Moderate: stoniness | Moderate: slope too steep | Severe: stoniness; slope; slow permeability. | Severe: stoniness; slow permeability. |
| Moderate to severe: stoniness; slope. | Severe: slope too steep | Severe: slope; stoniness; slow permeability. | Severe: stoniness; slope too steep. |
| Severe: cobbly | Moderate: slope too steep | Slight[1] | Slight. |
| Severe: cobbly | Severe: slope too steep | Moderate to severe:[1] slope too steep. | Severe: cobbly. |
| Severe: slope too steep; cobbly. | Severe: slope too steep | Severe: slope too steep | Severe: slope too steep. |
| Slight | Slight | Slight[1] | Moderate: coarse fragments. |
| Moderate: coarse fragments; slope. | Moderate to severe: slope | Moderate:[1] slope | Moderate: coarse fragments. |
| Moderate: coarse fragments; slope. | Slight to moderate: slope | Slight[1] | Moderate: coarse fragments. |
| Moderate to severe: slope; coarse fragments. | Severe: slope too steep | Moderate:[1] slope | Moderate to severe: slope. |
| Severe: slope too steep | Severe: slope too steep | Severe: slope too steep | Severe: slope too steep. |
| Slight | Moderate: seasonal high water table; slope. | Severe:[2] slow permeability; seasonal high water table. | Severe: seasonal high water table; slow permeability. |
| Moderate: slope | Severe: slope too steep | Severe:[2] slope too steep; slow permeability; seasonal high water table. | Severe: seasonal high water table; slope too steep; slow permeability. |
| Severe: stoniness | Severe: stoniness | Severe: stoniness; seasonal high water table; slow permeability. | Severe: stoniness; seasonal high water table. |
| Severe: stoniness; slope too steep. | Severe: slope too steep; stoniness. | Severe: stoniness; seasonal high water table; slope too steep. | Severe: stoniness; seasonal high water table; slope too steep. |
| Moderate: stoniness | Moderate: stoniness; seasonal high water table; slope. | Severe:[2] seasonal high water table; slow permeability. | Severe: stoniness; seasonal high water table. |
| Moderate to severe: slope too steep; stoniness. | Severe: slope | Severe:[2] seasonal high water table; slope; slow permeability. | Severe: stoniness; seasonal high water table; slope too steep. |
| Severe: stoniness | Severe: 2 to 4 feet to bedrock; slope too steep. | Severe: stoniness; 2 to 4 feet to bedrock. | Severe: stoniness; 2 to 4 feet to bedrock. |
| Severe: stoniness; slope too steep. | Severe: slope too steep | Severe: stoniness; slope too steep. | Severe: stoniness; slope. |
| Severe: slope too steep | Severe: slope too steep | Severe: slope too steep | Severe: slope too steep. |

TABLE 7.—*Major limitations that influence use of the soils for*

| Soil series and mapping symbols | Estimated degree of limitation for— | | |
|---|---|---|---|
| | Disposal of effluent from septic tanks | Sewage lagoons | Homesites of 3 stories or less with basements; subdivisions |
| Dekalb—Continued | | | |
| DsB (For Swartswood part, see SwB). | Severe: 2 to 4 feet to bedrock | Severe: rapid permeability; 2 to 4 feet to bedrock. | Severe: 2 to 4 feet to bedrock |
| DsD (For Swartswood part, see SwD). | Severe: slope too steep | Severe: slope too steep | Severe: 2 to 4 feet to bedrock; slope too steep. |
| DsF (For Swartswood part, see SwD). | Severe: slope too steep | Severe: slope too steep | Severe: slope too steep |
| Holly: | | | |
| Ho | Severe: flooding; high water table. | Severe: flooding | Severe: flooding; high water table. |
| Manlius: | | | |
| MaB | Severe: 1½ to 3½ feet to bedrock. | Severe: 1½ to 3½ feet to bedrock. | Severe: 1½ to 3½ feet to bedrock. |
| MaD | Severe: 1½ to 3½ feet to bedrock. | Severe: 1½ to 3½ feet to bedrock. | Severe: 1½ to 3½ feet to bedrock; slope too steep. |
| MlB | Severe: 1½ to 3½ feet to bedrock. | Severe: 1½ to 3½ feet to bedrock. | Severe: 1½ to 3½ feet to bedrock. |
| MlD | Severe: 1½ to 3½ feet to bedrock; slope too steep. | Severe: slope too steep | Severe: slope; 1½ to 3½ feet to bedrock. |
| MlF | Severe: slope too steep | Severe: slope too steep | Severe: slope too steep |
| Mardin: | | | |
| MnB2 | Severe: slow permeability; seasonal high water table. | Moderate: slope | Moderate: seasonal high water table. |
| MnC2 | Severe: slow permeability; seasonal high water table. | Severe: slope too steep | Moderate: seasonal high water table; slope. |
| MoB | Severe: slow permeability; seasonal high water table. | Moderate: stoniness; slope | Moderate: seasonal high water table. |
| MoC | Severe: slow permeability; seasonal high water table. | Severe: slope too steep | Moderate to severe: seasonal high water table; slope. |
| Middlebury: | | | |
| Mr | Severe: flooding; seasonal high water table. | Severe: flooding | Severe: flooding |
| Morris: | | | |
| MsB2 | Severe: slow permeability; seasonal high water table. | Moderate: slope | Severe: seasonal high water table. |
| MtB | Severe: slow permeability; seasonal high water table. | Moderate: slope | Severe: seasonal high water table. |
| MtC | Severe: slow permeability; seasonal high water table. | Severe: slope too steep | Severe: seasonal high water table. |
| Muck: | | | |
| Mu | Severe: high water table | Severe: organic material | Severe: high water table; unstable. |
| Norwich: | | | |
| NoA, NrB | Severe: slow permeability; high water table. | Moderate: possibility of inflow; slope. | Severe: high water table |
| Oquaga: | | | |
| OaB2 | Severe: 2 to 3½ feet to bedrock. | Severe: moderately rapid permeability; 2 to 3½ feet to bedrock. | Severe: 2 to 3½ feet to bedrock. |
| OeB | Severe: 2 to 3½ feet to bedrock. | Severe: moderately rapid permeability; 2 to 3½ feet to bedrock. | Severe: stoniness; slope too steep. |
| OeD | Severe: slope too steep; 2 to 3½ feet to bedrock. | Severe: slope too steep | Severe: slope too steep; stoniness. |
| OeF | Severe: slope too steep | Severe: slope too steep | Severe: slope too steep |

See footnotes at end of table.

*community developments, and estimated degree of limitation*—Continued

| Estimated degree of limitation for—Continued | | | |
|---|---|---|---|
| Landscaping and lawns at homesites | Streets and parking lots in subdivisions | Sanitary land fill | Cemeteries |
| Moderate: stoniness | Severe: 2 to 4 feet to bedrock | Severe: 2 to 4 feet to bedrock | Severe: stoniness; 2 to 4 feet to bedrock. |
| Moderate to severe: stoniness: slope. | Severe: slope too steep | Severe: 2 to 4 feet to bedrock | Severe: stoniness; 2 to 4 feet to bedrock. |
| Severe: slope too steep | Severe: slope too steep | Severe: slope too steep | Severe: slope too steep. |
| Severe: flooding | Severe: flooding | Severe: flooding; high water table. | Severe: flooding; high water table. |
| Moderate: rocky: 1½ to 3½ feet to bedrock. | Severe: rocky | Severe: rocky | Severe: rocky. |
| Severe: rocky; slope too steep. | Severe: slope too steep | Severe: rocky; slope too steep | Severe: slope too steep. |
| Severe: rocky | Severe: rocky | Severe: rocky | Severe: rocky. |
| Severe: rocky; slope too steep. | Severe: slope too steep | Severe: slope too steep | Severe: rocky. |
| Severe: slope too steep | Severe: slope too steep | Severe: slope too steep | Severe: slope too steep. |
| Slight | Moderate: seasonal high water table; slope. | Severe: seasonal high water table; slow permeability. | Severe: seasonal high water table; slow permeability. |
| Moderate: slope | Severe: slope too steep | Severe: seasonal high water table; slow permeability. | Severe: seasonal high water table; slow permeability. |
| Moderate: stoniness | Moderate: seasonal high water table; slope. | Severe: seasonal high water table; slow permeability. | Severe: seasonal high water table; stoniness. |
| Moderate to severe: slope; stoniness. | Severe: slope too steep | Severe: seasonal high water table; slope; slow permeability. | Severe: stoniness; seasonal high water table. |
| Moderate: flooding | Moderate: seasonal high water table; flooding. | Severe: flooding | Severe: flooding. |
| Moderate: seasonal high water table. | Moderate: seasonal high water table; slope. | Severe: seasonal high water table. | Severe: seasonal high water table. |
| Moderate: seasonal high water table; stoniness. | Moderate: seasonal high water table; slope. | Severe: seasonal high water table. | Severe: seasonal high water table; stoniness. |
| Moderate: seasonal high water table; stoniness. | Severe: slope too steep | Severe: seasonal high water table. | Severe: seasonal high water table; stoniness. |
| Severe: high water table | Severe: high water table and subsidence. | Severe: high water table | Severe: high water table; stoniness. |
| Severe: high water table | Severe: high water table | Severe: high water table | Severe: high water table. |
| Moderate: 2 to 3½ feet to bedrock. | Moderate: 2 to 3½ feet to rock. | Severe: 2 to 3½ feet to bedrock. | Severe: 2 to 3½ feet to bedrock. |
| Severe: stoniness | Severe: stoniness | Severe: stoniness; 2 to 3½ feet to bedrock. | Severe: stoniness; 2 to 3½ feet to bedrock. |
| Severe: stoniness; slope too steep. | Severe: slope too steep | Severe: slope too steep; stoniness. | Severe: slope too steep; stoniness. |
| Severe: slope too steep | Severe: slope too steep | Severe: slope too steep; stoniness. | Severe: slope too steep. |

TABLE 7.—*Major limitations that influence use of the soils for*

| Soil series and mapping symbols | Estimated degree of limitation for— Disposal of effluent from septic tanks | Sewage lagoons | Homesites of 3 stories or less with basements; subdivisions |
|---|---|---|---|
| Oquaga—Continued | | | |
| OvB | Moderate: 2 to 3½ feet to bedrock. | Severe: moderately rapid permeability; 2 to 3½ feet to bedrock. | Severe: 2 to 3½ feet to bedrock. |
| OvD | Severe: slope too steep; 2 to 3½ feet to bedrock. | Severe: slope too steep | Severe: slope too steep; 2 to 3½ feet to bedrock. |
| Papakating: | | | |
| Pa | Severe: flooding; high water table. | Severe: flooding | Severe: flooding; high water table. |
| Peat: | | | |
| Pe, Ps | Severe: high water table | Severe: organic soil | Severe: high water table; low bearing value. |
| Red Hook: | | | |
| Rh | Severe: seasonal high water table. | Severe: permeable substratum | Severe: seasonal high water table. |
| Rushtown: | | | |
| RwE | Severe: slope too steep | Severe: slope too steep | Severe: slope too steep |
| Swartswood: | | | |
| StB2 | Moderate: slope | Moderate to severe: slope | Moderate: slope |
| StC2 | Moderate to severe: slope | Severe: slope too steep | Severe: slope |
| SwB | Moderate: slope; stoniness | Moderate to severe: slope | Moderate: stoniness; slope |
| SwD | Moderate to severe: slope | Severe: slope too steep | Severe: slope too steep |
| Tioga: | | | |
| Ta | Severe: flooding | Severe: flooding | Severe: flooding |
| TgA | Moderate: [1] flooding | Severe: rapid permeability | Moderate: flooding |
| TgB | Moderate: [1] flooding | Severe: rapid permeability | Moderate: flooding |
| To | Severe: flooding | Severe: flooding | Severe: flooding |
| Tughill: | | | |
| TsA, TtA | Severe: high water table | Slight | Severe: high water table |
| Tunkhannock: | | | |
| TuB | Slight to moderate:[1] slope | Severe:[1] rapid permeability | Moderate: slope |
| TuC | Moderate to severe:[1] slope | Severe: slope too steep; rapid permeability. | Moderate to severe: slope |
| TuD | Severe: slope too steep | Severe: slope too-steep | Severe: slope too steep |
| Volusia: | | | |
| VcA | Severe: seasonal high water table; slow permeability. | Slight | Severe: seasonal high water table. |
| VcB2 | Severe: high water table; slow permeability. | Moderate: slope | Severe: seasonal high water table. |
| VuB | Severe: high water table; slow permeability. | Slight to moderate: slope | Severe: seasonal high water table. |
| VuD | Severe: high water table; slow permeability. | Severe: slope too steep | Severe: seasonal high water table; slope too steep. |
| Wurtsboro: | | | |
| WuB | Severe: slow permeability; seasonal high water table. | Slight to moderate: slope | Moderate: seasonal high water table. |
| WuC | Severe: slope; slow permeability; seasonal high water table. | Severe: slope too steep | Moderate to severe: seasonal high water table; slope. |

[1] Ground water can be contaminated by seepage through rapidly permeable fractured rock, open gravel, or cavernous limestone.

*community developments, and estimated degree of limitation*—Continued

| Estimated degree of limitation for—Continued | | | |
|---|---|---|---|
| Landscaping and lawns at homesites | Streets and parking lots in subdivisions | Sanitary land fill | Cemeteries |
| Moderate: stoniness; 2 to 3½ feet to bedrock. | Moderate: stoniness; 2 to 3½ feet to rock. | Severe: 2 to 3½ feet to bedrock. | Severe: stoniness; 2 to 3½ feet to bedrock. |
| Severe: slope too steep. | Severe: slope too steep. | Severe: slope too steep; 2 to 3½ feet to bedrock. | Severe: slope too steep; stoniness. |
| Severe: flooding; high water table. | Severe: flooding; high water table. | Severe: flooding; high water table. | Severe: flooding; high water table. |
| Severe: high water table. | Severe: high water table; subsidence. | Severe: high water table. | Severe: high water table. |
| Moderate: seasonal high water table. | Moderate: seasonal high water table. | Severe: high water table. | Severe: high water table. |
| Severe: slope too steep. | Severe: slope too steep. | Severe: slope too steep. | Severe: slope too steep. |
| Slight to moderate: slope. | Moderate to severe: slope. | Slight to moderate: slope. | Slight to moderate: slope. |
| Moderate to severe: slope. | Severe: slope too steep. | Moderate to severe: slope. | Moderate to severe: slope. |
| Moderate: stoniness; slope. | Slight to severe: slope. | Moderate: stoniness. | Severe: stoniness. |
| Moderate to severe: slope too steep; stoniness. | Severe: slope too steep. | Moderate to severe: slope. | Severe: stoniness; slope. |
| Moderate: flooding. | Severe: flooding. | Severe: flooding. | Severe: flooding. |
| Slight. | Slight. | Moderate: flooding. | Slight. |
| Slight to moderate: slope. | Severe: slope too steep. | Moderate: flooding. | Moderate: slope. |
| Moderate: flooding. | Severe: flooding. | Severe: flooding. | Severe: flooding. |
| Severe: high water table. | Severe: high water table. | Severe: high water table. | Severe: high water table. |
| Moderate: coarse fragments; slope. | Moderate: slope. | Slight to moderate:[1] slope. | Slight. |
| Moderate: coarse fragments; slope. | Severe: slope too steep. | Moderate to severe: slope. | Moderate to severe: slope. |
| Severe: slope too steep. | Severe: slope too steep. | Severe: slope too steep. | Severe: slope too steep. |
| Moderate: seasonal high water table. | Moderate: seasonal high water table. | Severe: seasonal high water table. | Severe: seasonal high water table. |
| Moderate: seasonal high water table. | Moderate: seasonal high water table; slope. | Severe: seasonal high water table. | Severe: seasonal high water table. |
| Moderate: seasonal high water table; stoniness. | Moderate: seasonal high water table; slope. | Severe: seasonal high water table. | Severe: seasonal high water table; stoniness. |
| Moderate to severe: seasonal high water table; slope. | Severe: slope too steep. | Severe: seasonal high water table; slope too steep. | Severe: seasonal high water table; stoniness; slope. |
| Moderate: stoniness. | Moderate: seasonal high water table; stoniness. | Severe: seasonal high water table; slow permeability. | Severe: stoniness. |
| Moderate to severe: stoniness; slope. | Severe: slope too steep. | Severe: slope; slow permeability; seasonal high water table. | Severe: stoniness; slope. |

[2] Ground water can be contaminated by movement of seepage water within the seasonal high water table.

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TABLE 8.—*Major limitations that influence use of the soils for*

[Four land types are too variable to be rated. These are Riverwash (Rv)

| Soil series and mapping symbols | Degree and kind of limitations for— Campsites: Tents | Campsites: Trailers | Service buildings (without basements) in recreational areas |
|---|---|---|---|
| Atherton: | | | |
| At | Severe: high water table | Severe: high water table | Severe: high water table |
| Braceville: | | | |
| BrA, BrB2 | Moderate: seasonal high water table. | Moderate: seasonal high water table. | Slight |
| Cattaraugus: | | | |
| CaB2 | Moderate: slow permeability | Moderate: slow permeability | Slight |
| CaC2 | Moderate: coarse fragments | Severe: slope | Moderate: slope |
| CeB | Severe: stoniness | Severe: stoniness | Moderate: stoniness |
| CeD | Severe: stoniness; slope | Severe: slope | Moderate: stoniness; slope |
| CgB | Moderate: stoniness; slow permeability. | Moderate: stoniness; slow permeability. | Slight to moderate: slope |
| CgD | Severe: slope | Severe: slope | Moderate: stoniness; slope |
| Chenango: | | | |
| ChB | Severe: cobbly | Severe: cobbly | Slight |
| ChC | Severe: cobbly | Severe: cobbly; slope | Moderate: slope |
| ChD | Severe: slope | Severe: slope | Moderate: slope |
| ClA | Moderate: gravelly | Moderate: gravelly | Slight |
| ClB2, CmB | Moderate: gravelly | Moderate: gravelly | Slight |
| CmC | Moderate: gravelly; slope | Severe: slope | Moderate: slope |
| CmD | Severe: slope | Severe: slope | Moderate: slope |
| Culvers: | | | |
| CnB2 | Moderate: coarse fragments | Moderate: coarse fragments | Slight |
| CnC2 | Moderate: coarse fragments; slope. | Severe: slope; coarse fragments. | Moderate: slope |
| CuB | Severe: stoniness | Severe: stoniness | Moderate: stoniness |
| CuD | Severe: slope | Severe: slope; stoniness | Moderate: stoniness |
| CvB | Moderate: stoniness | Moderate: stoniness; slope | Slight |
| CvC | Moderate: slope; stoniness | Severe: slope | Moderate: slope |
| Dekalb: | | | |
| DeB | Severe: stoniness | Severe: stoniness | Moderate: stoniness |
| DeD | Severe: slope; stoniness | Severe: slope; stoniness | Moderate: stoniness |
| DeF | Severe: slope | Severe: slope; stoniness | Severe: slope |
| DsB | Moderate: stoniness | Moderate: stoniness; slope | Slight |
| DsD | Severe: slope | Severe: slope | Moderate to severe: slope |
| DsF | Severe: slope | Severe: slope | Severe: slope |
| Holly: | | | |
| Ho | Severe: flooding; high water table. | Severe: flooding; high water table. | Severe: flooding; high water table. |

*specified recreational developments, and estimated degree of limitation*

Stony and cobbly alluvial land (Sc), and Stony lands (SmD and SsF)]

| Degree and kind of limitations for—Continued | | | |
|---|---|---|---|
| Paths and trails in camping areas | Picnic and play areas (extensive use) | Athletic fields (intensive use) | Golf fairways |
| Severe: high water table | Severe: high water table | Severe: high water table | Severe: high water table. |
| Slight | Slight | Moderate: seasonal high water table. | Moderate: gravelly. |
| Slight | Slight | Moderate: slow permeability; slope. | Moderate: coarse fragments. |
| Moderate: slope | Moderate: slope | Severe: slope | Moderate: coarse fragments; slope. |
| Moderate: stoniness | Moderate: stoniness | Severe: stoniness | Severe: stoniness. |
| Severe: slope | Severe: slope | Severe: stoniness; slope | Severe: stoniness; slope. |
| Slight | Slight to moderate: slope | Moderate: stoniness | Moderate: stoniness; slope. |
| Moderate to severe: slope | Severe: slope | Severe: slope | Severe: slope. |
| Slight | Severe: cobbly | Severe: cobbly | Severe: cobbly. |
| Moderate: slope | Severe: cobbly | Severe: slope; cobbly | Severe: cobbly. |
| Severe: slope | Severe: slope; cobbly | Severe: slope | Severe: slope; cobbly. |
| Slight | Slight | Moderate: gravelly | Moderate: gravelly. |
| Slight | Slight | Moderate: gravelly; slope | Moderate: gravelly. |
| Moderate: slope | Moderate: slope | Severe: slope | Moderate: gravelly; slope. |
| Severe: slope | Severe: slope | Severe: slope | Severe: slope. |
| Slight | Slight | Severe: coarse fragments; slow permeability; seasonal high water table. | Moderate: coarse fragments. |
| Moderate: slope | Moderate: slope | Severe: slope; coarse fragments. | Moderate: coarse fragments. |
| Moderate: stoniness | Moderate: stoniness | Severe: stoniness | Severe: stoniness. |
| Severe: slope | Severe: slope; stoniness | Severe: slope | Severe: slope. |
| Slight | Slight | Severe: coarse fragments; slow permeability. | Severe: coarse fragments. |
| Moderate: slope | Moderate: slope | Severe: slope | Severe: coarse fragments. |
| Moderate: stoniness | Moderate: 2 to 4 feet to bedrock; stoniness. | Severe: stoniness | Severe: stoniness. |
| Severe: slope | Severe: slope too steep; stoniness. | Severe: slope too steep; stoniness. | Severe: slope; stoniness. |
| Severe: slope | Severe: slope too steep | Severe: slope too steep; stoniness. | Severe: slope; stoniness. |
| Slight | Moderate: 2 to 4 feet to bedrock. | Severe: coarse fragments; 2 to 4 feet to bedrock. | Severe: coarse fragments. |
| Severe: slope | Severe: slope too steep | Severe: slope too steep; coarse fragments. | Severe: slope. |
| Severe: slope | Severe: slope | Severe: slope | Severe: slope. |
| Severe: flooding; high water table. | Severe: flooding; high water table. | Severe: flooding; high water table. | Severe: flooding; high water table. |

TABLE 8.—*Major limitations that influence use of the soils for specified*

| Soil series and mapping symbols | Degree and kind of limitations for— Campsites: Tents | Campsites: Trailers | Service buildings (without basements) in recreational areas |
|---|---|---|---|
| Manlius: | | | |
| MaB | Moderate: 1½ to 3½ feet to bedrock. | Moderate: 1½ to 3½ feet to bedrock. | Slight. |
| MaD | Severe: slope too steep | Severe: slope too steep | Moderate: slope |
| MlB | Moderate: rocky | Moderate: rocky | Moderate: rocky |
| MlD | Severe: slope too steep | Severe: slope too steep | Moderate: rocky; slope |
| MlF | Severe: slope | Severe: slope | Severe: slope |
| Mardin: | | | |
| MnB2 | Severe: slow permeability; seasonal high water table. | Severe: slow permeability; seasonal high water table. | Slight. |
| MnC2 | Moderate: slope; seasonal high water table. | Severe: slope | Moderate: slope |
| MoB | Severe: coarse fragments; slow permeability; seasonal high water table. | Severe: coarse fragments; slow permeability. | Slight. |
| MoC | Severe: slow permeability; seasonal high water table; coarse fragments. | Severe: slope; coarse fragments. | Moderate: slope |
| Middlebury: | | | |
| Mr | Moderate: flooding; seasonal high water table. | Moderate: flooding; seasonal high water table. | Severe: flooding |
| Morris: | | | |
| MsB2 | Severe: seasonal high water table. | Severe: seasonal high water table. | Moderate: seasonal high water table. |
| MtB | Severe: seasonal high water table. | Severe: seasonal high water table. | Moderate: seasonal high water table. |
| MtC | Severe: seasonal high water table. | Severe: seasonal high water table; slope. | Severe: seasonal high water table; slope. |
| Muck: | | | |
| Mu | Severe: high water table | Severe: high water table | Severe: high water table |
| Norwich: | | | |
| NoA, NrB | Severe: high water table | Severe: high water table | Severe: high water table |
| Oquaga: | | | |
| OaB2 | Moderate: slope; 2 to 3½ feet to bedrock. | Moderate to severe: slope | Slight. |
| OeB | Severe: stoniness | Severe: stoniness | Moderate: stoniness |
| OeD | Severe: stoniness; slope | Severe: stoniness; slope | Moderate: stoniness; slope |
| OeF | Severe: stoniness; slope | Severe: stoniness; slope | Severe: slope |
| OvB | Moderate: stoniness; slope; 2 to 3½ feet to bedrock. | Moderate to severe: stoniness; slope. | Slight. |
| OvD | Severe: slope | Severe: slope | Moderate: slope |
| Papakating: | | | |
| Pa | Severe: high water table | Severe: high water table | Severe: high water table |
| Peat: | | | |
| Pe, Ps | Severe: high water table | Severe: high water table | Severe: high water table; subsidence. |
| Red Hook: | | | |
| Rh | Severe: high water table | Severe: high water table | Moderate: high water table |
| Rushtown: | | | |
| RwE | Severe: slope | Severe: slope | Severe: slope |

*recreational developments, and estimated degree of limitation*—Continued

| Degree and kind of limitations for—Continued | | | |
|---|---|---|---|
| Paths and trails in camping areas | Picnic and play areas (extensive use) | Athletic fields (intensive use) | Golf fairways |
| Slight | Moderate: 1½ to 3½ feet to bedrock. | Severe: rocky; 1½ to 3½ feet to bedrock. | Moderate: rocky; 1½ to 3½ feet to bedrock. |
| Severe: slope | Severe: slope too steep | Severe: slope too steep | Severe: slope. |
| Slight | Moderate: rocky | Severe: rocky | Severe: rocky. |
| Severe: slope | Severe: slope; rocky | Severe: slope too steep; rocky. | Severe: rocky; slope. |
| Severe: slope | Severe: slope | Severe: slope | Severe: slope. |
| Slight | Slight | Moderate: seasonal high water table. | Moderate: coarse fragments. |
| Moderate: slope | Moderate: slope | Severe: slope too steep | Moderate: coarse fragments; slope. |
| Slight | Slight | Moderate: seasonal high water table; stoniness. | Severe: coarse fragments. |
| Moderate: slope | Moderate: slope | Severe: slope too steep | Severe: coarse fragments. |
| Moderate: flooding | Moderate: flooding | Moderate: flooding; seasonal high water table. | Moderate: flooding. |
| Moderate: seasonal high water table. | Moderate: seasonal high water table. | Severe: seasonal high water table. | Moderate: seasonal high water table; coarse fragments. |
| Moderate: seasonal high water table. | Moderate: seasonal high water table. | Severe: seasonal high water table. | Severe: coarse fragments. |
| Moderate: seasonal high water table; slope. | Moderate: high water table; slope. | Severe: slope; seasonal high water table. | Severe: coarse fragments; slope. |
| Severe: high water table | Severe: high water table; subsidence. | Severe: high water table; subsidence. | Severe: high water table. |
| Severe: high water table | Severe: high water table | Severe: high water table | Severe: high water table. |
| Slight | Moderate: 2 to 3½ feet to bedrock. | Severe: 2 to 3½ feet to bedrock. | Moderate: depth to bedrock. |
| Moderate: stoniness | Moderate: stoniness; 2 to 3½ feet to bedrock. | Severe: stoniness; 2 to 3½ feet to bedrock. | Severe: stoniness. |
| Severe: slope | Severe: slope | Severe: slope too steep | Severe: stoniness. |
| Severe: stoniness | Severe: slope too steep | Severe: slope too steep | Severe: stoniness. |
| Slight | Moderate: 2 to 3½ feet to bedrock. | Severe: 2 to 3½ feet to bedrock. | Severe: coarse fragments. |
| Severe: slope | Severe: slope | Severe: slope | Severe: slope. |
| Severe: high water table | Severe: high water table | Severe: high water table | Severe: high water table. |
| Severe: high water table | Severe: high water table | Severe: high water table; subsidence. | Severe: high water table. |
| Moderate: high water table | Moderate: high water table | Severe: seasonal high water table. | Moderate: seasonal high water table. |
| Severe: slope | Severe: slope | Severe: slope | Severe: slope. |

TABLE 8.—*Major limitations that influence use of the soils for specified*

| Soil series and mapping symbols | Degree and kind of limitations for— Campsites: Tents | Campsites: Trailers | Service buildings (without basements) in recreational areas |
|---|---|---|---|
| Swartswood: | | | |
| StB2 | Moderate: slope | Severe: slope | Moderate: slope |
| StC2 | Severe: slope | Severe: slope | Moderate: slope |
| SwB | Moderate: slope; stoniness | Severe: slope | Moderate: slope |
| SwD | Severe: slope | Severe: slope | Moderate: slope |
| Tioga: | | | |
| Ta | Moderate: flooding | Moderate: flooding | Severe: flooding |
| TgA | Slight | Slight | Moderate: flooding |
| TgB | Moderate: slope | Severe: slope | Moderate: flooding |
| To | Moderate: flooding | Moderate: flooding | Severe: flooding |
| Tughill: | | | |
| TsA, TtA | Severe: high water table | Severe: high water table | Severe: high water table |
| Tunkhannock: | | | |
| TuB | Moderate: gravelly | Moderate: gravelly; slope | Slight |
| TuC | Moderate: gravelly; slope | Severe: slope | Moderate: slope |
| TuD | Severe: slope | Severe: slope | Moderate: slope |
| Volusia: | | | |
| VcA | Severe: seasonal high water table. | Severe: seasonal high water table. | Moderate: seasonal high water table. |
| VcB2 | Severe: seasonal high water table. | Severe: seasonal high water table. | Moderate: seasonal high water table. |
| VuB | Severe: seasonal high water table. | Severe: seasonal high water table. | Moderate: seasonal high water table. |
| VuD | Severe: seasonal high water table; slope. | Severe: seasonal high water table; slope. | Moderate: seasonal high water table; slope. |
| Wurtsboro: | | | |
| WuB | Severe: slow permeability; seasonal high water table. | Severe: slow permeability; seasonal high water table. | Slight |
| WuC | Severe: slope | Severe: slope | Moderate: slope |

Most of the soils in the county are rated in table 8 for recreational uses in terms of the degree of limitation, and the ratings are *slight*, *moderate*, and *severe*. The degree of limitation indicates the severity of the problems that are likely to be encountered if the specified use is made. The exact basis for a decision to use or not to use a soil for one of these purposes, regardless of its limitations, is beyond the scope of this publication.

A rating of slight means that the soil has few, if any, limitations for the use specified. A rating of moderate means that the soil has one or more properties that limit its use for the purpose specified. Correction of the limiting factors increases the cost of installing and maintaining the necessary practices. A rating of severe means that the soil has one or more properties that limit seriously its use for the purpose specified. Correction of some of the limiting factors is possible, but correction of others is prohibitive in cost.

*Campsites for tents and trailers.*—The ratings under these headings apply to use of the soil for campsites and for the other activities of outdoor living in a camp. It is assumed that the sites are used frequently during the camping season. The sites require little preparation other than shaping and leveling space for the tent and for parking. The soils should be suitable for heavy foot traffic, for riding trails, and for some vehicular traffic. Suitability of the soil for supporting vegetation was not considered in making these ratings but should be considered whenever an area is selected to be used for campsites.

*Buildings without basements.*—These ratings are based on limitations of the soil for use as building sites for year-round and seasonal cottages, for washrooms and bathhouses, for picnic shelters, and for service buildings. If service buildings are built with basements, the depth of soil and a seasonal high water table might limit some of the soils more severely than the rating in table 8 indicates. The suitability of the soil for supporting vegetation did not enter into the ratings but should be considered whenever the site for a proposed building is evaluated.

*Paths and trails.*—These ratings apply to use of the soils for trails, cross-country hiking, and bridle paths and for other nonintensive uses that allow for random movement

*recreational developments, and estimated degree of limitation*—Continued

| Degree and kind of limitations for—Continued | | | |
|---|---|---|---|
| Paths and trails in camping areas | Picnic and play areas (extensive use) | Athletic fields (intensive use) | Golf fairways |
| Slight | Slight | Moderate: coarse fragments; slope. | Moderate: coarse fragments. |
| Moderate: slope | Moderate: slope | Severe: slope | Moderate: coarse fragments; slope. |
| Slight | Slight | Severe: coarse fragments; slope. | Severe: coarse fragments. |
| Severe: slope | Severe: slope too steep | Severe: slope | Severe: slope; coarse fragments. |
| Moderate: flooding | Moderate: flooding | Moderate: flooding; surface texture. | Moderate: flooding; surface texture. |
| Slight | Slight | Moderate: surface texture | Moderate: surface texture. |
| Slight | Slight | Moderate: surface texture | Moderate: surface texture. |
| Moderate: flooding | Moderate: flooding | Moderate: flooding | Moderate: flooding. |
| Severe: high water table | Severe: high water table | Severe: high water table | Severe: high water table. |
| Slight | Slight | Moderate: gravelly; slope | Moderate: gravelly. |
| Moderate: slope | Moderate: slope | Severe: slope | Moderate: gravelly; slope. |
| Severe: slope | Severe: slope | Severe: slope | Severe: slope. |
| Moderate: seasonal high water table. | Moderate: seasonal high water table. | Severe: seasonal high water table. | Moderate: seasonal high water table. |
| Moderate: seasonal high water table. | Moderate: seasonal high water table. | Severe: seasonal high water table. | Moderate: seasonal high water table. |
| Moderate: seasonal high water table. | Moderate: seasonal high water table. | Severe: seasonal high water table. | Severe: coarse fragments. |
| Severe: slope | Severe: slope | Severe: high water table; slope. | Severe: coarse fragments; slope. |
| Slight | Slight | Severe: seasonal high water table; slow permeability. | Severe: coarse fragments. |
| Moderate: slope | Moderate: slope | Severe: slope; stoniness | Severe: coarse fragments. |

of people. It is assumed that the soils are to be used as they occur in nature and that little or no soil is to be moved in preparing for the planned recreational use. Swamps, marshes, peat bogs, and sand dunes are examples of the soils or land types that have very severe limitations for this use.

*Picnic and play areas.*—These ratings apply to use of the soils for parks, picnic areas, and other forms of recreation in which the soils are left mostly in their natural state. Space for trails, picnic sites, and other small areas can be cleared, and should be maintained in sod. The main soil features that affect use for parks and picnic areas are the slope, the incidence of flooding, the presence of a high water table, texture of the soil, and the presence of rocks or stones. Some areas that are steep or rocky can be used for nature trails, or they make attractive scenic spots. The ratings for these uses are based on soil features only. Other features, such as the kinds of trees or other vegetation and the presence of lakes affect the desirability of most sites. The suitability of the soil for supporting vegetation did not enter into the ratings but should be considered whenever a site is evaluated.

*Athletic fields.*—These ratings apply to use of the soils for playgrounds and for playing fields for football, baseball, tennis, volleyball, badminton, or other sports. Since the playing fields must be nearly level, considerable shaping of the soils may be needed. A soil that has a large amount of clay or gravel in the surface layer generally is not well suited for one of these uses. Other limiting soil features are the degree of slope, the depth to and the kind of bedrock, the presence of a high water table, the presence of rocks or stones, and the risk of flooding or of local ponding. Playing fields are subject to intensive foot traffic and should have good drainage, and the soil texture and consistence should permit a firm surface to be maintained. A soil that is good for playing fields generally has physical properties that favor the growth of good grass or other desirable cover, but additions of fertilizer and other amendments might be necessary.

*Golf fairways.*—In making the ratings for this use, it was assumed that grass, shrubs, and trees are to be grown

without additions of topsoil and without any shaping of the surface. Traps and roughs were not considered to be part of the fairways.

## *Descriptions of the Soils*

This section describes the soil series and mapping units of Pike County. The acreage and proportionate extent of each mapping unit are given in table 9. The distribution and extent of the soils in the county are shown on the soil map at the back of this survey.

The procedure is, first, to describe the soil series and, then, the mapping units in that series. The descriptions are in alphabetical order. To get full information on any mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Riverwash, for example, is a miscellaneous land type that does not belong to a soil series. It is described, nevertheless, in alphabetic order along with the soil series. Described along with some mapping units are small areas of contrasting soils that are included in some of the areas mapped.

A short description of each soil series, in paragraph form, precedes a technical profile description that identifies layers by A, B, and C horizons and depth ranges (*14*). The technical profile descriptions are mainly for soil scientists and others who want detailed information about soils. Some of the technical terms used in this survey are defined in the Glossary.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Mentioned at the end of each description of a mapping unit are the capability unit and the woodland suitability group in which the mapping unit has been placed. The page on which each capability unit and each woodland suitability group is described can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The color of each horizon is described in words, such as yellowish brown, and is also given by symbols for the hue, value, and chroma, such as 10YR 5/4. These symbols, called Munsell color notations, are used by soil scientists to evaluate the color of the soil precisely. In this survey the names of the colors and the color symbols are for moist soil unless otherwise stated.

Soil structure refers to the way individual soil particles are arranged in larger grains or aggregates and the amount of pore space between grains. The structure of the soil is described by giving the strength or grade, the size, and the shape of the aggregates. For example a horizon may have "weak, fine, blocky structure." Other terms used in describing soil structure are defined in the Glossary.

The boundaries between soil horizons are described so as to indicate their thickness and shape. The terms for thickness are abrupt, clear, gradual, and diffuse. The shape of the boundary is described as smooth, wavy, irregular, or broken.

Many of the soils of Pike County are less than 3 feet deep to bedrock. Soils on flood plains and soils in colluvial material are built up by the slow addition of alluvial or colluvial material on the surface and are the deepest soils in the county. Most of the soils are moderately deep, 20 to 36 inches to bedrock. Many of the soils, however, have a firm fragipan layer that cannot be readily penetrated by roots. The fragipan decreases the effective depth of the soil. The effective depth of a number of soils is further limited by a seasonal high water table. The fragipan and seasonal high water table limit the root depth of many of the soils.

Soil erosion is active on many soils of the county, especially cultivated soils that are sloping or steep. Typically, the profile of a moderately or severely eroded soil differs from the uneroded soil of the same series in three ways. The present surface layer is thinner and lighter colored; the soil contains less organic matter; and the root zone is shallower.

Natural drainage of a soil is influenced by its depth, texture, structure, slope, permeability, and available moisture capacity, and by the position of the water table. In this survey the terms used to describe natural drainage indicate the thickness of the aerated root zone of the soils. The principal terms are—*well drained*, at least 36 inches of aerated root zone; *moderately well drained*, 18 to 36 inches; *somewhat poorly drained*, 8 to 18 inches; *poorly drained*, 0 to 8 inches; and *very poorly drained*, no well-aerated root zone.

### Atherton Series

The Atherton series consists of poorly drained and very poorly drained soils that were formed in grayish glacial outwash composed of stratified sand and silt and of lenses of gravel and clay. These soils are medium acid to strongly acid.

The Atherton are nearly level or concave soils on stream terraces. The water table tends to rise above their surface during wet seasons.

A typical Atherton soil has a surface layer of very dark brown loam about 8 inches thick. It is dark colored because of the accumulated organic matter. The subsurface layer is dark-gray loam, has light brownish-gray mottles, and is about 4 inches thick. The subsoil is grayish-brown loam to sandy loam that has very pale brown and gray mottles. The subsoil extends from a depth of 12 to 42 inches or more and is medium acid. The deeper layers in many places are stratified sand and gravel.

Profile of Atherton loam southwest of Shohola Falls in an idle field:

A1—0 to 8 inches, very dark brown (10YR 2/2) loam; moderate, fine granular structure; friable when moist, nonsticky and nonplastic when wet; pH 5.6; clear, smooth lower boundary. 6 to 10 inches thick.

A2g—8 to 12 inches, dark-gray (10YR 4/1) loam; common, coarse, distinct, yellowish-brown (10YR 5/6) and light brownish-gray (10YR 6/2) mottles; moderate, coarse, granular structure; friable when moist, slightly sticky and nonplastic when wet; pH 5.4; clear, smooth lower boundary. 4 to 6 inches thick.

B2g—12 to 30 inches, grayish-brown (10YR 5/2) loam; distinct, light yellowish-brown (10YR 6/4), very pale brown (10YR 7/4), and gray (N 6/0) mottles and streaks; moderate, thick, platy and coarse, blocky structure; firm when moist, sticky and slightly plastic when wet; pH 5.6; diffuse, smooth lower boundary. 15 to 20 inches thick.

TABLE 9.—*Approximate acreage and proportionate extent of the soils*

| Soil | Area | Extent | Soil | Area | Extent |
|---|---|---|---|---|---|
| | *Acres* | *Percent* | | *Acres* | *Percent* |
| Atherton loam | 622 | 0. 2 | Mardin very stony loam, 0 to 8 percent slopes | 33, 642 | 9. 4 |
| Braceville gravelly loam, 0 to 3 percent slopes | 365 | . 1 | Mardin very stony loam, 8 to 25 percent slopes | 11, 095 | 3. 1 |
| Braceville gravelly loam, 3 to 8 percent slopes, moderately eroded | 821 | . 2 | Middlebury loam | 628 | . 2 |
| Cattaraugus channery sandy loam, 3 to 12 percent slopes, moderately eroded | 1, 657 | . 5 | Morris channery loam, 3 to 8 percent slopes, moderately eroded | 498 | . 1 |
| Cattaraugus channery sandy loam, 12 to 20 percent slopes, moderately eroded | 841 | . 2 | Morris very stony loam, 0 to 8 percent slopes | 11, 401 | 3. 2 |
| | | | Morris very stony loam, 8 to 15 percent slopes | 260 | . 1 |
| Cattaraugus extremely stony sandy loam, 0 to 12 percent slopes | 375 | . 1 | Muck | 107 | (1) |
| Cattaraugus extremely stony sandy loam, 12 to 30 percent slopes | 76 | (1) | Norwich channery silt loam, 0 to 3 percent slopes | 109 | (1) |
| Cattaraugus very stony sandy loam, 0 to 12 percent slopes | 13, 483 | 3. 8 | Norwich very stony silt loam, 0 to 8 percent slopes | 4, 501 | 1. 3 |
| Cattaraugus very stony sandy loam, 12 to 30 percent slopes | 10, 720 | 3. 0 | Oquaga channery loam, 3 to 12 percent slopes, moderately eroded | 333 | . 1 |
| Chenango cobbly sandy loam, 3 to 12 percent slopes | 4, 787 | 1. 3 | Oquaga extremely stony loam, 0 to 12 percent slopes | 7, 006 | 2. 0 |
| Chenango cobbly sandy loam, 12 to 20 percent slopes | 4, 924 | 1. 4 | Oquaga extremely stony loam, 12 to 30 percent slopes | 12, 638 | 3. 5 |
| Chenango cobbly sandy loam, 20 to 30 percent slopes | 766 | . 2 | Oquaga extremely stony loam, 30 to 80 percent slopes | 6, 979 | 2. 0 |
| Chenango gravelly loam, 0 to 3 percent slopes | 193 | . 1 | Oquaga very stony loam, 0 to 12 percent slopes | 3, 596 | 1. 0 |
| | | | Oquaga very stony loam, 12 to 30 percent slopes | 3, 536 | 1. 0 |
| Chenango gravelly loam, 3 to 12 percent slopes, moderately eroded | 1, 235 | . 3 | Papakating silt loam | 2, 012 | . 6 |
| | | | Peat | 302 | . 1 |
| Chenango gravelly sandy loam, 0 to 12 percent slopes | 1, 429 | . 4 | Peat, shallow | 2, 311 | . 6 |
| | | | Red Hook loam | 486 | . 1 |
| Chenango gravelly sandy loam, 12 to 20 percent slopes | 330 | . 1 | Riverwash | 120 | (1) |
| Chenango gravelly sandy loam, 20 to 30 percent slopes | 616 | . 2 | Rushtown very shaly silt loam, 25 to 45 percent slopes | 222 | . 1 |
| | | | Stony and cobbly alluvial land | 6, 131 | 1. 7 |
| Culvers channery loam, 2 to 8 percent slopes, moderately eroded | 2, 714 | . 8 | Stony land, moderately steep | 10 | (1) |
| | | | Stony land, steep | 4, 926 | 1. 4 |
| Culvers channery loam, 8 to 15 percent slopes, moderately eroded | 812 | . 2 | Swartswood channery sandy loam, 3 to 12 percent slopes, moderately eroded | 869 | . 2 |
| Culvers extremely stony loam, 0 to 8 percent slopes | 935 | . 3 | Swartswood channery sandy loam, 12 to 20 percent slopes, moderately eroded | 347 | . 1 |
| Culvers extremely stony loam, 8 to 25 percent slopes | 567 | . 2 | Swartswood very stony sandy loam, 0 to 12 percent slopes | 19, 014 | 5. 3 |
| Culvers very stony loam, 0 to 8 percent slopes | 22, 296 | 6. 2 | Swartswood very stony sandy loam, 12 to 30 percent slopes | 9, 123 | 2. 6 |
| Culvers very stony loam, 8 to 25 percent slopes | 10, 303 | 2. 9 | Tioga loamy fine sand | 125 | (1) |
| Dekalb extremely stony sandy loam, 0 to 12 percent slopes | 5, 178 | 1. 4 | Tioga loamy fine sand, high bottom, 0 to 3 percent slopes | 579 | . 2 |
| Dekalb extremely stony sandy loam, 12 to 30 percent slopes | 9, 302 | 2. 6 | Tioga loamy fine sand, high bottom, 3 to 12 percent slopes | 1, 122 | . 3 |
| | | | Tioga silt loam | 852 | . 2 |
| Dekalb extremely stony sandy loam, 30 to 80 percent slopes | 4, 119 | 1. 2 | Tughill channery silt loam, 0 to 3 percent slopes | 189 | . 1 |
| | | | Tughill very stony loam, 0 to 3 percent slopes | 12, 673 | 3. 5 |
| Dekalb-Swartswood very stony sandy loams, 0 to 12 percent slopes | 6, 929 | 1. 9 | Tunkhannock gravelly sandy loam, 3 to 12 percent slopes | 1, 626 | . 5 |
| Dekalb-Swartswood very stony sandy loams, 12 to 30 percent slopes | 13, 167 | 3. 7 | Tunkhannock gravelly sandy loam, 12 to 20 percent slopes | 1, 164 | . 3 |
| Dekalb-Swartswood very stony sandy loams, 30 to 80 percent slopes | 1, 493 | . 4 | Tunkhannock gravelly sandy loam, 20 to 30 percent slopes | 232 | . 1 |
| Holly silt loam | 1, 880 | . 5 | Volusia channery loam, 0 to 3 percent slopes | 241 | . 1 |
| Manlius rocky silt loam, 0 to 12 percent slopes | 1, 067 | . 3 | | | |
| Manlius rocky silt loam, 12 to 30 percent slopes | 2, 154 | . 6 | Volusia channery loam, 3 to 8 percent slopes, moderately eroded | 873 | . 2 |
| Manlius very rocky silt loam, 0 to 12 percent slopes | 3, 701 | 1. 0 | Volusia very stony silt loam, 0 to 8 percent slopes | 17, 425 | 4. 9 |
| Manlius very rocky silt loam, 12 to 30 percent slopes | 7, 823 | 2. 2 | Volusia very stony silt loam, 8 to 25 percent slopes | 329 | . 1 |
| Manlius very rocky silt loam, 30 to 80 percent slopes | 3, 335 | . 9 | Wurtsboro very stony sandy loam, 0 to 8 percent slopes | 17, 037 | 4. 8 |
| Mardin channery silt loam, 2 to 8 percent slopes, moderately eroded | 2, 852 | . 8 | Wurtsboro very stony sandy loam, 8 to 25 percent slopes | 7, 032 | 2. 0 |
| | | | Water | 8, 320 | 2. 3 |
| Mardin channery silt loam, 8 to 15 percent slopes, moderately eroded | 1, 232 | . 3 | Total | 357, 120 | 100. 0 |

Less than 0.05 percent.

B3g—30 to 42 inches +, gray (N 6/0) and very pale brown (10YR 7/4) sandy loam; massive to weak, coarse, blocky structure; firm when moist, nonsticky and nonplastic when wet; pH 5.8. 12 to 30 inches thick.

Color of the A horizon ranges from very dark brown or very dark gray to gray. The content of coarse fragments ranges from none to as much as 30 percent in some places in the lower subsoil. Thin deposits of local alluvium have accumulated on the surface in many places.

The Atherton soils are associated most closely with the somewhat poorly drained Red Hook soils, the moderately well drained Braceville soils, and the well drained Chenango soils, all having similar parent material.

**Atherton loam** (At).—A profile of this soil was described as typical for the Atherton series. This soil is a nearly level soil in depressions or at the base of slopes where surface water accumulates or where water is received by underground seepage. Wetness is the major limitation. There is little or no erosion hazard.

This soil is suitable for farming if adapted crops are grown in a low-intensity rotation. Drainage should be installed to lower the water table and make the soil easier to manage. (Capability unit IIIw–1; woodland suitability group 16)

## Braceville Series

The Braceville series consists of deep, moderately well drained, gravelly soils formed in grayish glacial outwash. These soils are nearly level or gently sloping and are on terraces and valley floors near the large streams.

A fragipan layer that is slowly permeable to air and water lies about 25 to 35 inches below the surface. This layer resists root penetration and holds the water table near the surface during wet seasons.

Most of the Braceville soils are used for crops or pasture. They have moderate limitations for cultivation and for use as building sites.

A typical Braceville soil that has been cultivated has a dark-brown gravelly loam plow layer that is easily tilled. This layer is medium acid and is about 7 inches thick. The upper subsoil is yellowish-brown friable gravelly loam that extends to a depth of about 30 inches. The lower part of this layer is light yellowish brown and has yellowish-brown and gray mottles. The lower subsoil contains a fragipan at a depth of about 30 inches. It is a very firm, grayish-brown, gravelly silt loam layer that is slowly permeable to water and hinders growth of roots. The subsoil is underlain by layers of sand and gravel that begin about 42 inches below the surface.

Profile of Braceville gravelly loam, 3 to 8 percent slopes, moderately eroded, north of Milford in a cultivated field:

Ap—0 to 7 inches, dark-brown (10YR 3/3) gravelly loam; 20 percent coarse sand and gravel; weak, medium, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 5.8; abrupt, smooth lower boundary. 6 to 8 inches thick.

B21—7 to 18 inches, yellowish-brown (10YR 5/4) gravelly loam; 30 percent coarse sand and gravel; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 5.6; gradual, smooth lower boundary. 10 to 14 inches thick.

B22—18 to 30 inches, light yellowish-brown (10YR 6/4) gravelly loam; common, medium, distinct, yellowish-brown (10YR 5/8) and gray (N 6/0) mottles; 25 percent gravel; weak, medium, subangular blocky structure; firm when moist, nonsticky and nonplastic when wet; pH 5.8; gradual, smooth lower boundary. 10 to 15 inches thick.

Bx—30 to 42 inches, grayish-brown (10YR 5/2) gravelly silt loam; very dark brown (10YR 2/2) coatings and concretions; 45 percent gravel; very coarse, prismatic structure breaking to angular blocky; very firm when moist, nonsticky and nonplastic when wet; pH 5.8. 12 to 24 inches thick.

C—42 to 48 inches +, stratified sand and gravel.

Colors in the solum range in hue from 10YR to 7.5YR. Depth to mottling ranges from 15 to 30 inches, and depth to the fragipan (Bx horizon) ranges from 25 to 35 inches.

Braceville soils are associated most closely with the well-drained Chenango soils, the somewhat poorly drained Red Hook soils, and the poorly drained to very poorly drained Atherton soils.

**Braceville gravelly loam, 0 to 3 percent slopes** (BrA).—This soil has a profile similar to that described for the series, but the surface layer is thicker and darker in color. This soil is in nearly level areas or in slight depressions. Wetness is the major limitation.

This soil is suited to plants that tolerate wetness, and is suitable for cultivation if the crop rotation of medium intensity is followed. Limitations for building sites are moderate because of the seasonal high water table. (Capability unit IIw–1; woodland suitability group 6)

**Braceville gravelly loam, 3 to 8 percent slopes, moderately eroded** (BrB2).—This soil has the profile described as typical for the Braceville series. The plow layer in most places is a mixture of the remaining surface soil and the light yellowish-brown subsoil.

Risk of erosion and the seasonal high water table are the major limitations in using this gently sloping soil. The soil is suited to most crops grown in the area, especially plants that tolerate a wet soil. Limitations for building sites are moderate. (Capability unit IIe-1; woodland suitability group 6)

## Cattaraugus Series

The Cattaraugus series consists of deep, well-drained channery sandy loam to extremely stony sandy loam soils that were formed in glacial till derived from mixed red and gray, acid sandstone and shale. These soils are gently sloping to moderately steep and are on convex slopes, mainly in the western part of the county.

The Cattaraugus soils are strongly acid to moderately acid. Most of them are wooded, and only small areas have been cleared for farming.

A typical Cattaraugus soil in woods has a thin, pinkish-gray, sandy loam surface layer under a thin, dark-brown organic mat. This surface layer of mineral soil is 1 inch to several inches thick. The upper subsoil is reddish-brown to light-brown channery sandy loam to channery loam that is friable and extends to a depth of 24 inches. The lower subsoil, below 24 inches, is brown loam and is 30 to 50 percent flat stone fragments. This layer is firm and somewhat brittle; it is slowly permeable to water and forms a barrier for roots.

Profile of Cattaraugus very stony sandy loam, 0 to 12 percent slopes, north of Promised Land in a wooded area:

O1—3 to 2 inches, dark reddish-brown (5YR 3/3) oak leaf litter.

O2—2 inches to 0, very dark brown (10YR 2/2) humus, held together in a mat by fine roots; abrupt, wavy lower boundary. 1 to 3 inches thick.

A2—0 to 1 inch, pinkish-gray (7.5YR 6/2) very stony sandy loam; 25 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and

nonplastic when wet; pH 4.8; abrupt, wavy lower boundary. 0 to 1½ inches thick.

B21—1 inch to 8 inches, reddish-brown (5YR 5/4) channery sandy loam; 20 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.8; gradual, wavy lower boundary. 6 to 8 inches thick.

B22—8 to 16 inches, light-brown (7.5YR 6/4) channery fine sandy loam; 20 percent coarse fragments; weak, medium, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.6; gradual, wavy lower boundary. 6 to 10 inches thick.

B23—16 to 24 inches, light-brown (7.5YR 6/4) channery loam; 25 percent coarse fragments; weak, medium, subangular blocky structure; firm when moist, nonsticky and nonplastic when wet; pH 5.0; clear, wavy lower boundary. 6 to 9 inches thick.

Bx1—24 to 32 inches, brown (7.5YR 5/4) channery loam; 30 percent coarse fragments; prismatic, breaking to moderate, medium, platy and blocky structure; firm when moist, slightly sticky and nonplastic when wet; pH 5.2; diffuse, wavy lower boundary. 6 to 10 inches thick.

Bx2—32 to 55 inches, dark-brown (7.5YR 4/2) channery loam; 45 percent coarse fragments; prismatic, breaking to weak, medium, platy and blocky structure; firm when moist, nonsticky and nonplastic when wet; pH 5.4; diffuse, wavy lower boundary. 20 to 25 inches thick.

Bx3—55 to 72 inches, brown (10YR 5/3) very channery loam; 50 percent coarse fragments; very dark grayish-brown (10YR 3/2) coatings and concretions; massive, breaking to weak, coarse, blocky structure; firm when moist, nonsticky and nonplastic when wet; pH 5.6 17 to 25 inches thick.

Color of the B horizon ranges from light brown to strong brown. Depth to bedrock ranges from 3 feet to more than 7 feet. Percentage of volume occupied by coarse fragments, including stones and boulders, ranges from 10 to 50 and is greatest on the steep slopes.

Cattaraugus soils are associated most closely with the moderately deep to deep Oquaga soils, the moderately well drained Culvers soils, and the somewhat poorly drained to poorly drained Morris soils; all have similar parent material. Cattaraugus soils are similar to the Swartswood soils but are reddish brown instead of yellowish brown.

**Cattaraugus channery sandy loam, 3 to 12 percent slopes, moderately eroded** (CaB2).—This soil has a profile similar to the one described as typical for the Cattaraugus series. This soil is not stony, however, and most areas of it have been cultivated. The present plow layer in most places is a mixture of the remaining surface soil and the reddish-brown upper subsoil. A few small areas of level or nearly level, uneroded soils were included with this soil in mapping.

Risk of erosion is the major limitation of this gently sloping, well-drained soil. Where cleared, it is suited to crops. This soil has only slight to moderate limitations for building sites. (Capability unit IIe–1; woodland suitability group 7)

**Cattaraugus channery sandy loam, 12 to 20 percent slopes, moderately eroded** (CaC2).—This soil has a profile similar to the one described for the series. It is sloping and channery but not stony, and most of it has been cultivated. The present plow layer in most places is a mixture of the remaining surface soil and the reddish-brown subsoil. Included in mapping were small, slightly eroded areas.

Risk of erosion is the major limitation. Where cleared, this soil is suited to most crops grown in the county. (Capability unit IIIe–1; woodland suitability group 7)

**Cattaraugus extremely stony sandy loam, 0 to 12 percent slopes** (CeB).—This soil has a profile similar to the one described for the series, but 15 to 50 percent of its surface is covered by stones and boulders. Most of the areas are in forest.

Stones limit the use of this soil. The soil is nearly level to gently sloping, and there is little or no erosion. Generally, it is not feasible to remove the trees and stones so that the soil can be farmed. The soil is suited to trees, but the stones make logging difficult. (Capability unit VIIs–1; woodland suitability group 7)

**Cattaraugus extremely stony sandy loam, 12 to 30 percent slopes** (CeD).—This soil has a profile similar to the one described for the series. It is moderately steep, and 15 to 50 percent of the surface is covered by stones and boulders. Most of the areas are in woods.

Stones are the major limitation of this soil. There is no erosion hazard as long as the soil remains in woods. The soil is suited to trees, but the stones make logging difficult. (Capability unit VIIs–1; woodland suitability group 7)

**Cattaraugus very stony sandy loam, 0 to 12 percent slopes** (CgB).—This soil has the profile described as typical for the Cattaraugus series. Stones and boulders cover from 3 to 15 percent of the surface. Most of the areas have not been cleared or cultivated.

Stones are the major limitation. There is very little if any erosion as long as the trees remain. This soil is well suited to trees. Removing the trees and stones to permit cultivation generally is not practical. This soil has moderate to severe limitations for building sites because of the stones. (Capability unit VIs–1; woodland suitability group 7)

**Cattaraugus very stony sandy loam, 12 to 30 percent slopes** (CgD).—This soil has a profile similar to the one described for the Cattaraugus series. It is steeper and has some ledges of rock. Most areas have not been cleared or cultivated. A few, very steep, nonstony areas were included with this soil in mapping.

Stones are the major limitation. There is very little erosion as long as the slopes are not cleared. This soil is suited to trees. The stones prevent cultivation, and removal of the trees and stones to permit cultivation generally is not feasible. The slopes are mostly too steep for building sites. (Capability unit VIs–1; woodland suitability group 7)

## Chenango Series

The Chenango series consists of deep, well-drained, gravelly and cobbly soils that were formed in grayish glacial outwash (fig. 5). These soils are mainly nearly level or gently sloping soils on outwash terraces in the valleys. Small areas are on the sides of valleys where former streams dropped their loads to form deltas or kames. Most of the Chenango soils are in the major stream valleys, but some areas are in the uplands.

The Chenango soils have low to moderate available moisture capacity. They have rapid permeability and are underlain by gravel. They are generally close to a source of water for irrigation.

The nearly level Chenango soils in the valley of the Delaware River are farmed. The use of these soils for the disposal of liquid sewage or other waste is likely to cause contamination of ground water.

A typical Chenango soil in woods has a surface layer of dark-brown gravelly loam 1 to 2 inches thick, under a layer of leaf litter and a black fibrous mat. The next layer

of mineral soil, which is part of the B horizon, is dark-brown cobbly sandy loam that is friable and easily tilled. This layer extends 4 inches below the surface. The middle subsoil is strong-brown gravelly sandy loam that is very friable and extends to 16 inches. The lower subsoil is very gravelly sandy loam that is 50 percent or more coarse fragments. The substratum is dark grayish-brown very gravelly sandy loam that is 90 percent coarse fragments. This material is open and very porous.


*Figure 5.*—**Typical profile of a Chenango gravelly sandy loam. Numbers on tape indicate depth in feet.**

Profile of Chenango gravelly loam, 3 to 12 percent slopes, moderately eroded, near Flat Ridge Road in a wooded area; sampled for characterization, Profile S64–Pa–52–3(1–6):

O1—2 inches to 1 inch, dark-brown (10YR 3/3) leaf litter, mostly oak leaves; pH 3.9; clear, wavy lower boundary.

O2—1 inch to 0, black (10YR 2/1) leaf mold, roots, and fungus mycelia, held together in a tough, fibrous mat; pH 4.0; abrupt, wavy lower boundary. ½ inch to 2 inches thick.

A2—0 to 2 inches, dark-brown (7.5YR 3/2) gravelly loam; 16 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 3.9; abrupt, wavy lower boundary. 1 to 3 inches thick.

B2ir—2 to 4 inches, dark-brown (7.5YR 4/4) cobbly sandy loam; 30 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.6; clear, wavy lower boundary. 1 to 3 inches thick.

B21—4 to 9 inches, strong-brown (7.5YR 5/6) gravelly sandy loam; 20 percent coarse fragments; weak, fine, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; pH 4.9; gradual, wavy lower boundary. 4 to 8 inches thick.

B22—9 to 16 inches, strong-brown (7.5YR 5/6) gravelly sandy loam; 20 percent coarse fragments; single grain; very friable when moist, nonsticky and nonplastic when wet; pH 4.5; clear, wavy lower boundary. 5 to 9 inches thick.

IIB23—16 to 26 inches, dark yellowish-brown (10YR 4/4) very gravelly sandy loam; 50 percent gravel and cobblestones, including some weathered remnants of basic gravel; single grain; silt and clay caps on gravel; friable when moist, nonsticky and nonplastic when wet; pH 4.6; gradual, wavy lower boundary. 8 to 12 inches thick.

IIC—26 to 50 inches +, dark grayish-brown (10YR 4/2) very gravelly sandy loam; 90 percent gravel and cobblestones, including weathered remnants of basic gravel; single grain; silt caps on gravel; very friable when moist, nonsticky and nonplastic when wet; pH 4.6. 24 to 36 inches thick.

The reaction ranges from extremely acid to very strongly acid in forests where no lime has been applied. Soils that have been limed and fertilized are less acid.

Texture of the A2 horizon ranges from cobbly and gravelly sandy loam to gravelly loam. The thickness of loamy or sandy material over gravel ranges from 20 to 30 inches. Color of the B horizon ranges from strong brown to dark brown. Depth of the solum ranges from 24 to more than 40 inches.

Chenango soils are associated mainly with the moderately well drained Braceville soils, the somewhat poorly drained Red Hook soils, and the poorly drained or very poorly drained Atherton soils. In many physical properties, they are similar to the Tunkhannock soils. Soils on the adjacent flood plains are generally Tioga and Middlebury soils.

**Chenango cobbly sandy loam, 3 to 12 percent slopes** (ChB).—This soil has a profile similar to the one described as typical for the series, but it is more sandy and has cobblestones on the surface. Most areas are rolling and have not been cultivated. The surface layer is darker and not so thick as on sites that have been plowed and cultivated. A few areas of a nearly level soil were included with the areas mapped.

Droughtiness is the major limitation of this Chenango soil. In sloping, cultivated fields the risk of erosion is also a problem. This soil is suited to many of the common crops if it is farmed in a rotation of medium intensity. The soil has slight limitations when used for building sites. (Capability unit IIs–1; woodland suitability group 9)

**Chenango cobbly sandy loam, 12 to 20 percent slopes** (ChC).—This soil has a profile similar to the one described for the series, but it is more sandy and cobbly. The soil is rolling to hilly. Most areas have not been cultivated, and the surface layer is darker and not so thick as in the cultivated soils.

Droughtiness is the major limitation. In cultivated fields, risk of erosion on the complex, rolling to hilly slopes is also a problem.

This soil is suitable for cultivation if a crop rotation of low intensity is followed and supporting conservation

practices are applied. It has moderate to severe limitations for building sites. (Capability unit IIIe–1; woodland suitability group 9)

**Chenango cobbly sandy loam, 20 to 30 percent slopes** (ChD).—This soil has a profile similar to the one described for the Chenango series, but it is coarser textured, more cobbly, and steeper. Most areas have not been cleared, and the surface layer is darker and not so thick as in the cultivated soils. Included in the mapping of this soil were a few slopes steeper than 30 percent and small areas of noncobbly soils.

Droughtiness and leaching of plant nutrients are the major limitations of this Chenango soil. These limitations are results of the moderately coarse texture and the strong slopes. This soil is suitable for farming when used in a rotation of very low intensity that is supported by conservation practices. This soil has severe limitations for use as building sites because of its slope. (Capability unit IVe–1; woodland suitability group 9)

**Chenango gravelly loam, 0 to 3 percent slopes** (ClA) This soil has a profile like the one described for the series. Where the soil has been cultivated, the plow layer is lighter in color than the surface layer under forest cover. Plowing has formed an Ap horizon about 12 inches thick. Most areas of this soil are along the Delaware River, where they have been cleared and cultivated.

The major limitation of this soil is its moderate to low available moisture capacity. This soil is one of the best in the county for crops and may be cultivated in a rotation of high intensity. It has few limitations for building sites. (Capability unit I–1; woodland suitability group 9)

**Chenango gravelly loam, 3 to 12 percent slopes, moderately eroded** (ClB2).—This soil has the profile described as typical for the Chenango series. It is gently sloping or sloping. Most of the areas are along the Delaware River and have been cultivated. The present plow layer in most fields is a mixture of the remaining surface soil and the yellowish-brown subsoil. A few areas of a nearly level and gently sloping silt loam soil were included in mapping this soil.

This Chenango soil is one of the good soils in the county for crops. The low available moisture capacity and a moderate erosion hazard are limitations when the soil is farmed. The soil is suited to the common crops grown in a moderately intensive rotation. The soil is suitable for building sites. (Capability unit IIe–1; woodland suitability group 9)

**Chenango gravelly sandy loam, 0 to 12 percent slopes** (CmB).—This soil has a profile similar to the one described as typical for the Chenango series, but it is more sandy. The surface layer is darker and thicker in the nearly level areas than on the moderate slopes. Most areas have been cultivated. A few areas of shaly sandy loam were included in the areas mapped.

The moderate to low available moisture capacity is the major limitation when crops are grown. This soil is suited to most crops grown in the area, especially early vegetables and truck crops. When this Chenango soil is cultivated, however, a crop rotation of medium intensity should be followed to maintain organic matter and help control erosion. The soil has moderate limitations for building sites. (Capability unit IIs–1; woodland suitability group 9)

**Chenango gravelly sandy loam, 12 to 20 percent slopes** (CmC).—This sloping soil has a profile similar to the one described as typical for the Chenango series. Most of the areas have been cultivated. A few areas of shaly sandy loam were included in the areas mapped.

The low available moisture capacity, the slope, and the risk of erosion are problems when this soil is cultivated. This soil is suited to most crops grown in the area. (Capability unit IIIe–1; woodland suitability group 9)

**Chenango gravelly sandy loam, 20 to 30 percent slopes** (CmD).—This soil has a profile similar to the one described as typical for the Chenango series. It is a steep soil on escarpments between terrace levels. A few areas of shaly sandy loam soil were included in the areas mapped. The steep slopes of this Chenango soil make cultivation difficult.

This Chenango soil is suited to general farm crops. It should be protected from erosion by a crop rotation of very low intensity, supported by conservation practices. The soil has severe limitations for building sites. (Capability unit IVe–1; woodland suitability group 9)

## Culvers Series

The Culvers series consists of deep, moderately well drained, channery to extremely stony soils that were formed in glacial till derived from red and gray, acid sandstone and shale. These soils are strongly acid to moderately acid and are on the uplands.

Culvers soils are mainly in the western part of the county. They are gently sloping to moderately steep. Most of the areas are wooded, but many of the nonstony soils have been cleared and farmed. Many areas are now idle.

Culvers soils have moderate available moisture capacity and they have slow permeability in the compact, fragipan subsoil. The seasonal high water table and the fragipan limit the choice of plants and also the use of the soils for building sites.

A typical wooded Culvers soil has a surface soil of pinkish-gray and brown, friable loam, about 7 inches thick, below a layer of leaves and a thin, very dark brown humus mat. The surface soil is very strongly acid.

The upper subsoil, to a depth of 15 inches, is fairly firm, light-brown channery loam that has a few, fine gray mottles. The lower subsoil is a brown channery loam fragipan that is blotched and streaked with light brown, gray, and dark gray. It is firm in place but rather brittle when spaded and extends from a depth of 15 to 60 inches. The substratum of glacial till is a grayish-brown channery sandy loam fragipan that is firm in place.

Profile of Culvers very stony loam, 0 to 8 percent slopes, west of Greeley in a wooded area:

O1—3 to 2 inches, dark reddish-brown (5YR 3/3) leaf litter.

O2—2 inches to 0, very dark brown (10YR 2/2) humus, held together in a fibrous mat.

A21—0 to ½ inch, pinkish-gray (7.5YR 6/2) very stony loam; 20 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.6; abrupt, smooth boundary. 0 to 2 inches thick.

A22—½ inch to 7 inches, brown (7.5YR 5/4) channery loam; 25 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.8; clear, smooth lower boundary. 6 to 10 inches thick.

B2—7 to 15 inches, light-brown (7.5YR 6/4) channery loam that has few, fine, distinct, gray (N 6/0) mottles; 15 percent coarse fragments; weak, medium, granular structure; firm when moist, nonsticky and nonplastic when wet; pH 5.0; clear, wavy lower boundary. 6 to 12 inches thick.

Bx1—15 to 32 inches, brown (7.5YR 5/2) channery loam that has common, medium, distinct, light-brown (7.5YR 6/4) and gray (N 6/0) mottles; 40 percent coarse fragments; prismatic, breaking to strong, coarse, blocky and strong, thick, platy structure; few, thin clay films; very firm when moist, slightly sticky and nonplastic when wet; pH 5.2; diffuse, irregular lower boundary. 15 to 20 inches thick.

Bx2—32 to 60 inches, brown (7.5YR 5/2) very channery loam; common, coarse, distinct, very dark gray (7.5YR 3/1) concretions and coatings; 50 percent coarse fragments; prismatic, breaking to moderate, medium, blocky and platy structure; firm when moist, nonsticky and nonplastic when wet; pH 5.2; diffuse, irregular lower boundary. 25 to 35 inches thick.

Cx—60 to 72 inches +, grayish-brown (10YR 5/2) very channery sandy loam; 50 percent coarse fragments; weak, coarse, subangular blocky and weak, thick, platy structure; firm when moist, nonsticky and nonplastic when wet; pH 5.4. 12 to 36 inches thick.

Depth to mottling ranges from 10 to 18 inches, and depth to the Bx horizon ranges from 15 to 24 inches. Color of the B horizon ranges from light brown to yellowish brown. Depth to bedrock is generally more than 5 feet.

Culvers soils are closely associated with the moderately deep to deep, well-drained Oquaga soils, the deep, well-drained Cattaraugus soils, the somewhat poorly drained to poorly drained Morris soils, and the very poorly drained Norwich soils. They are similar to Mardin soils but have a brown solum rather than one that is yellowish brown to olive brown.

**Culvers channery loam, 2 to 8 percent slopes, moderately eroded** (CnB2).—This soil has a profile similar to the one described for the Culvers series, but it is channery rather than very stony and has been eroded. Most areas have been cultivated. The present plow layer in most places is a mixture of the remaining surface soil and the brown subsoil. It is slightly thicker and lighter in color than the A22 horizon described as typical in a wooded area.

This soil is gently sloping and moderately well drained. Risk of erosion is the major problem when it is farmed. The soil is not suited to crops that are sensitive to the seasonal high water table in the root zone. A crop rotation of medium intensity should be followed to conserve soil and water. This soil has moderate limitations for building sites because of the high water table. (Capability unit IIw–1; woodland suitability group 6)

**Culvers channery loam, 8 to 15 percent slopes, moderately eroded** (CnC2).—This soil has a profile similar to the one described for the Culvers series, but it is more sloping and is channery rather than very stony. Most of the areas have been cultivated. The present plow layer in most places is a mixture of the remaining surface soil and the brown subsoil. A few moderately steep areas, a few severely eroded areas, and some uneroded areas in woods were included in mapping this soil.

Risk of erosion under cultivation and the seasonal high water table are the major problems when this Culvers soil is farmed. The soil is suited to most crops grown in the area that will tolerate some wetness. Crops should be grown in a rotation of low intensity, supported by surface drainage and erosion control practices. This Culvers soil has moderate limitations for building sites because of its seasonal high water table and slope. (Capability unit IIIe–2; woodland suitability group 6)

**Culvers extremely stony loam, 0 to 8 percent slopes** (CuB).—This soil has a profile similar to the one described for the Culvers series, except that it is more stony. Most areas are wooded and have not been cleared or cultivated.

Stones are the major limitation when the soil is used. Slopes are gentle, and there is little or no erosion in wooded areas. This soil is too stony to be used for crops; it is suited to trees and can be used for recreational areas. This soil is generally too stony for building sites. (Capability unit VIIs–1; woodland suitability group 6)

**Culvers extremely stony loam, 8 to 25 percent slopes** (CuD).—This soil has a profile similar to the one described for the Culvers series, but it is steeper and more stony. Most areas are wooded and have not been cleared or cultivated.

This soil is not suited to crops, because of the stones and slope. It is suited to trees, wildlife habitats, and recreational areas. The stones make logging difficult. (Capability unit VIIs–1; woodland suitability group 6)

**Culvers very stony loam, 0 to 8 percent slopes** (CvB).—This soil has the typical profile that is described for the Culvers series. From 3 to 15 percent of the surface is covered by stones and boulders. Most areas have not been cultivated.

Stones are the major limitation. The soil is nearly level to gently sloping, and there is little if any erosion. It is suited to trees, pasture, and wildlife habitats. The stones prevent cultivation, and it is generally not practical to clear the areas of stones and trees. (Capability unit VIs–1; woodland suitability group 6)

**Culvers very stony loam, 8 to 25 percent slopes** (CvC).—This soil has a profile similar to the typical one described for the Culvers series. From 3 to 15 percent of the surface is covered by stones and boulders. The slopes are moderately steep. Most areas have not been cultivated, because of the stones and trees.

Stones and slopes offer the major problems in using this soil. The stones make cultivation impractical, and the soil is best suited to pasture, trees, and wildlife habitats. Much of this soil is too steep for building sites. (Capability unit VIs–1; woodland suitability group 6)

## Dekalb Series

The Dekalb series consists of moderately deep to deep, well-drained soils formed mainly in residuum from gray sandstone bedrock that contained a few thin strata of siltstone or shale. The bedrock in some places was loosened and broken by frost action. These soils are on uplands, escarpments, and ridges.

The Dekalb soils have moderate to low available moisture capacity, rapid permeability, and low natural fertility. Most of the areas are wooded. The soils tend to be too droughty for good farming, and too stony and shallow for good building sites.

A typical Dekalb soil in a wooded area has a dark-brown to grayish-brown surface layer of extremely stony sandy loam that is easily worked. This layer is about 12 inches thick. The subsoil is brown to yellowish-brown channery loam or very channery loam, and a large amount of it is coarse fragments. This layer extends from 12 to about 28 inches. The substratum is yellowish-brown, friable very channery sandy loam and is about 75 percent coarse

fragments. It extends to about 40 inches and is underlain by hard, light-colored sandstone.

Profile of Dekalb extremely stony sandy loam, 0 to 12 percent slopes, southwest of McConnell Pond in a wooded area:

O2—1 inch to 0, black (10YR 2/1) humus, held together in a tough fibrous mat; pH 4.8; clear, smooth lower boundary. 0 to 3 inches thick.

A1—0 to 9 inches, dark-brown (10YR 4/3) extremely stony sandy loam; 25 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.6; clear, wavy lower boundary. 7 to 11 inches thick.

A2—9 to 12 inches, grayish-brown (10YR 5/2) channery loam; 25 percent coarse fragments; weak, medium, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.4; clear, wavy lower boundary. 2 to 4 inches thick.

B1—12 to 18 inches, brown (10YR 5/3) channery loam; 30 percent coarse fragments; weak, medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; pH 4.6; clear, wavy lower boundary. 5 to 9 inches thick.

B2—18 to 28 inches, yellowish-brown (10YR 5/4) very channery loam; 50 percent coarse fragments; weak, medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; pH 4.6; gradual, irregular lower boundary. 6 to 12 inches thick.

C—28 to 40 inches, yellowish-brown (10YR 5/6) very channery sandy loam; 75 percent coarse fragments; single grain; friable when moist, nonsticky and nonplastic when wet; pH 4.4. 10 to 18 inches thick.

R—40 inches +, sandstone bedrock, somewhat broken and fissured.

Depth to bedrock ranges from 20 to 40 inches or more, but in most places it is less than 30 inches. The volume occupied by stones and boulders ranges from 15 to 50 percent and is greatest in the steep soils.

The Dekalb soils are closely associated with the deep, well-drained Swartswood soils. They are near the moderately well drained Wurtsboro soils, the somewhat poorly drained or poorly drained Volusia soils, and the very poorly drained Tughill soils. They are similar to the Oquaga soils but have a brown or yellowish-brown to brownish-yellow, sandy solum rather than one of brown to reddish-brown silt loam to loam.

**Dekalb extremely stony sandy loam, 0 to 12 percent slopes** (DeB).—This soil has the profile that is described for the Dekalb series. From 15 to 50 percent of the surface is covered by stones, boulders, or outcrops of bedrock. Most areas are wooded and have not been cleared.

Stones limit the use of this soil. Slopes are nearly level or gentle, and there is very little if any erosion. The soil is too stony for farming, but it is suited to trees and wildlife habitats. Stones and boulders make logging difficult and limit use of the soil for building sites. (Capability unit VIIs–1; woodland suitability group 14)

**Dekalb extremely stony sandy loam, 12 to 30 percent slopes** (DeD).—This soil has a profile similar to the one described as typical for the Dekalb series. It is shallower to bedrock, and 15 to 50 percent of its surface is covered by stones, boulders, or outcrops of bedrock. Most areas are wooded and have not been cleared.

Stones are the major limitation of this soil. There is very little erosion, because of the tree cover, even though the slopes are moderately steep. The soil is too stony for field crops but is suited to trees and wildlife habitats. Stones and boulders make logging difficult. Use for large buildings is not practical, because of the slopes. (Capability unit VIIs–1; woodland suitability group 14)

**Dekalb extremely stony sandy loam, 30 to 80 percent slopes** (DeF).—This soil has a profile similar to the one described for the Dekalb series. Most areas are in forests and have not been cleared.

Stones and slope are the major limitations of this soil. The soil is too steep and stony for crops and is better suited to trees and wildlife habitats. Stones and boulders and the steep and very steep slopes make logging difficult. The steep slopes make this soil generally unsuitable for building sites. (Capability unit VIIs–1; woodland suitability group 15)

**Dekalb-Swartswood very stony sandy loams, 0 to 12 percent slopes** (DsB).—In some places Dekalb soils and Swartswood soils form an intricate pattern and cannot be shown separately at the scale of the soil map. In this complex of nearly level to sloping, very stony soils, each of the soils has a profile similar to the one described for its series. Each soil has 3 to 15 percent of its surface covered with stones and boulders. All the areas are wooded. The soils are well drained.

Stones are the major limitation. There is little or no erosion. The soils are too stony for cultivation but are suited to permanent pasture, trees, and wildlife. (Capability unit VIs–1; woodland suitability group 14)

**Dekalb-Swartswood very stony sandy loams, 12 to 30 percent slopes** (DsD).—Each of these soils has a profile similar to the one described as typical for its series. Both soils are moderately steep. Stones and boulders cover 3 to 15 percent of the surface. The soil are wooded and have not been cultivated. A few areas of a strongly sloping channery loam were included in the mapping of this complex.

Stones and slopes are the major limitations. The soils of this complex are suited to pasture, trees, and wildlife habitats. The slopes make the soils unsuitable for large buildings. (Capability unit VIs–1; woodland suitability group 14)

**Dekalb-Swartswood very stony sandy loams, 30 to 80 percent slopes** (DsF).—Each of these soils has a profile similar to the typical one described for its series. The areas are wooded, and few if any have ever been cleared.

Stones and slopes are the major limitations. The soils are suited to trees and wildlife habitats. Steep and very steep slopes make the soils generally not suited to building sites. (Capability unit VIIs–1; woodland suitability group 15)

## Holly Series

The Holly series consists of deep, poorly drained, silty soils that were formed in brown sediments deposited by streams. These soils are nearly level or concave and are on flood plains and abandoned stream channels of the bottom lands.

The position of these soils in the landscape and their slow permeability result in a high water table most of the year, which impedes growth of plant roots. Holly soils are frequently flooded, and therefore are suited best to a crop rotation of low intensity or to permanent pasture. Most of the acreage is in pasture or forest. The high water table limits the soils severely for building sites.

A typical Holly soil, described in an idle field, has a dark grayish-brown, silt loam plow layer that is easily worked. This layer is about 7 inches thick. The subsoil is light

brownish-gray, friable silt loam that has yellowish-brown and gray mottles. This friable layer extends to 20 inches. Below 20 inches is light olive-gray loam that is streaked and blotched with rust and light gray. The deeper substratum is gravelly or sandy in some places.

Profile of Holly silt loam southwest of Blooming Grove in an idle field:

A1—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 5.8; gradual, smooth lower boundary. 6 to 9 inches thick.

B2g—7 to 20 inches, light brownish-gray (2.5Y 6/2) silt loam; common, coarse, distinct, yellowish-brown (10YR 5/8) and gray (N 6/0) mottling, and streaks of iron stain; weak, medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; pH 5.6; gradual, smooth lower boundary. 12 to 18 inches thick.

Cg—20 to 42 inches +, light olive-gray (5Y 6/2) loam streaked with iron stains; weak, medium, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 5.8. 22 to 40 inches thick.

Beneath the surface layer, the texture ranges from sandy loam through loam to silt loam. Mottling is present in most profiles within 6 inches of the surface. Numerous pebbles and shale fragments are in the soil in some places where a drainageway enters the flood plain.

**Holly silt loam** (Ho).—This soil has the profile described as typical for the Holly series. Wetness is its major limitation. The soil lies in low places, is nearly level, and is likely to be covered by floodwaters from streams or by water from local sources for periods of several days or longer.

This soil is suited to occasional cultivation in a rotation that includes long-term hay. It is also suited to pasture and trees. The high water table and the hazard of frequent flooding limit the soil severely for building sites. (Capability unit IVw–1; woodland suitability group 4)

## Manlius Series

The Manlius series consists of moderately deep, well-drained, shaly soils that were formed in glacial till on ground moraines or in residuum from fractured, acid, gray shale and siltstone. These soils are strongly acid. They are gently sloping to very steep, very rocky or rocky soils on ridgetops and on the steep escarpments along the Delaware River bluffs.

Manlius soils have low or very low available moisture capacity and moderately rapid permeability. They tend to be droughty, and even the gentle slopes are severely limited for farming. Most of the very rocky areas are wooded. Some of the rocky areas have been cleared for crops and pasture. The rocks and steep slopes are severe limitations for building sites.

A typical Manlius soil in a forest has an upper mineral layer of dark yellowish-brown silt loam, about 3 inches thick, that is easily worked. It underlies a layer of leaves and leaf mold several inches thick. The next layer is friable, yellowish-brown shaly silt loam that is very strongly acid and extends to a depth of 8 inches. The subsoil is friable, strong-brown to dark-brown very shaly silt loam to a depth of about 25 inches. The substratum consists of dark yellowish-brown very shaly silt loam and is about 90 percent coarse fragments. This layer begins at a depth of about 25 inches and is underlain by fractured, dark-gray siltstone.

Profile of Manlius very rocky silt loam, 0 to 12 percent slopes, near Conashaugh in a wooded area; sampled for characterization, Profile S64–Pa–52–6(1–7):

O1—1½ inches to ½ inch, dark reddish-brown (5YR 3/2) leaf litter, oak and pine leaves; pH 3.8; clear, smooth lower boundary.

O2—½ inch to 0, black (10YR 2/1) leaf mold; pH 3.9; abrupt, smooth lower boundary.

A1—0 to 3 inches, dark yellowish-brown (10YR 4/4) shaly silt loam; 40 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.2; clear, wavy lower boundary. 1 to 4 inches thick.

A2—3 to 8 inches, yellowish-brown (10YR 5/4) shaly silt loam; 40 percent coarse fragments; weak, fine, granular and subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; pH 4.4; clear, wavy lower boundary. 3 to 7 inches thick.

B2—8 to 19 inches, strong-brown (7.5YR 5/6) very shaly silt loam; 50 percent coarse fragments; weak, subangular blocky structure; few thin clay films; friable when moist, slightly sticky and slightly plastic when wet; pH 4.4; gradual, wavy lower boundary. 8 to 14 inches thick.

B3—19 to 25 inches, dark-brown (7.5YR 4/4) very shaly silt loam; 80 percent coarse fragments; weak, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; pH 4.8; clear, broken lower boundary. 0 to 8 inches thick.

C—25 to 30 inches, dark yellowish-brown (10YR 4/4) very shaly silt loam; 90 percent coarse fragments; structure controlled by coarse fragments; friable when moist, nonsticky and nonplastic when wet; pH 4.8; clear, irregular lower boundary. 4 to 10 inches thick.

R—30 to 36 inches +, dark-gray (N 4/0) siltstone fragments, fractured and displaced.

Depth to bedrock ranges mainly from 20 to 40 inches. Bedrock commonly is exposed at the surface on steep slopes and in places scraped by glacial ice.

Manlius soils are associated with the deeper, moderately well drained Mardin soils and the somewhat poorly drained or poorly drained Volusia soils. They are also associated with Dekalb, Oquaga, and Rushtown soils, and with Stony land, steep, along the Delaware River bluffs. They are similar to the Dekalb soils, but have a finer textured profile and are browner. They are not so red as the Oquaga soils.

**Manlius rocky silt loam, 0 to 12 percent slopes** (MaB).—This soil has a profile similar to the one described as typical for the Manlius series, except that it is not so rocky. In most cultivated areas the plow layer is a mixture of the remaining surface soil and the strong-brown subsoil. The plow layer in a cultivated area is slightly darker than the second layer of mineral soil in the profile described.

The rocks, low moisture-holding capacity, and risk of erosion limit the use of this soil. This soil is fairly well suited to crops in a rotation of low intensity. It has moderate limitations for building sites because of the rock outcrops. (Capability unit IIIe–1; woodland suitability group 11)

**Manlius rocky silt loam, 12 to 30 percent slopes** (MaD).—This soil has a profile similar to the one described as typical for the Manlius series, but it is moderately steep and less stony. In most cultivated areas the plow layer is a mixture of the remaining surface soil and the strong-brown subsoil.

Slope, rocks, low moisture-holding capacity, and risk of erosion limit the use of this soil. The soil is poorly suited to cultivation but can be farmed in a crop rotation of very low intensity. The moderately steep slopes and the rocks are severe limitations for building sites. (Capability unit VIs–1; woodland suitability group 11)

**Manlius very rocky silt loam, 0 to 12 percent slopes** (MlB).—This soil has the profile described as typical for the Manlius series. Outcrops of bedrock make up 3 to 15 percent of the surface.

Droughtiness and rocks are the major limitations. There is little erosion, since the slopes are nearly level to gentle and the areas are wooded. Most of this soil lies just back of the bluffs along the river, and is too rocky to be farmed. It is better suited to pasture, trees, or wildlife habitat than to crops. The moderate depth and the rocks are limitations for building sites. (Capability unit VIs–1; woodland suitability group 11)

**Manlius very rocky silt loam, 12 to 30 percent slopes** (MlD).—This soil has a profile similar to the one described for the series, but it is moderately steep. Most of the areas are wooded and are along the edges of the Delaware River bluffs. The soil is too rocky and steep to be farmed for crops but is fairly well suited to extensive pasture. The moderately steep slopes, ledges, and moderate depth limit the use of this soil for building sites. (Capability unit VIs–1; woodland suitability group 11)

**Manlius very rocky silt loam, 30 to 80 percent slopes** (MlF).—This soil has a profile similar to the one described as typical for the series. It is steep or very steep. Most of the areas are on the bluffs of the valley of the Delaware River. Mainly the areas are forested. Droughtiness and rock outcrops are the major limitations. The soil is too steep and stony for uses other than for trees, wildlife, or recreational areas. The steep slopes and rocks limit this soil severely for building sites. (Capability unit VIIs–1; woodland suitability group 12)

## Mardin Series

The Mardin series consists of deep, moderately well drained, channery to very stony soils that were formed in glacial till derived from olive-gray, acid siltstone and sandstone. These soils are on uplands in the eastern two-thirds of the county where gray rocks are predominant. They are gently sloping to moderately steep. The soils are very strongly acid and have a well-developed fragipan that begins about 20 inches below the surface. Large areas are stony and are wooded.

Mardin soils have low to moderate available moisture capacity and slow permeability throughout the profile. The growth of roots and the flow of water through the soil are impeded by the fragipan.

A typical wooded Mardin soil has a light brownish-gray channery loam or very stony loam surface layer, only a few inches thick, under a layer of leaves and a very dark gray, fibrous organic mat. The upper subsoil is friable, yellowish-brown channery loam or very stony loam to a depth of about 14 inches. Between 14 and 20 inches, there is lighter yellowish-brown channery loam that is friable when moist. This layer has been leached and in that way is like the upper part of the surface soil. Between 20 and 28 inches, there is firm, dark yellowish-brown channery silt loam that has grayish-brown mottles. This is the upper part of the fragipan. Between 28 and 68 inches is the middle part of the fragipan. This layer consists of very firm, olive-brown channery loam that has coarse, black coatings and concretions. The layer below 68 inches is dark grayish-brown, very firm, very channery loam to channery sandy loam.

Profile of Mardin very stony loam, 0 to 8 percent slopes, west of Conashaugh in a wooded area:

O2—2 inches to 0, very dark gray (10YR 3/1) humus held together in a tough, fibrous mat by fine roots; pH 5.6; abrupt, smooth lower boundary. 1 to 3 inches thick.

A2—0 to 2 inches, light brownish-gray (10YR 6/2) very stony loam; 20 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 5.0; clear, smooth lower boundary. 1 to 3 inches thick.

B2—2 to 14 inches, yellowish-brown (10YR 5/6) very stony loam; 20 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 5.4; clear, smooth lower boundary. 8 to 15 inches thick.

A'2—14 to 20 inches, yellowish-brown (10YR 5/4) channery loam; 20 percent coarse fragments; very weak, medium, platy structure; friable when moist, nonsticky and nonplastic when wet; pH 5.2; clear, smooth lower boundary. 4 to 8 inches thick.

B'x1—20 to 28 inches, dark yellowish-brown (10YR 4/4) channery silt loam; few, fine, grayish-brown (10YR 5/2) mottles; 25 percent coarse fragments; weak, medium, blocky and platy structure; few thin clay films; firm when moist, slightly sticky and nonplastic when wet; pH 5.4; gradual, smooth lower boundary. 6 to 10 inches thick.

B'x2—28 to 68 inches, olive-brown (2.5Y 4/4) very channery loam; common, coarse, distinct, black (10YR 2/1) concretions and coatings; 50 percent coarse fragments; strong, coarse, prismatic breaking to strong, thick, platy and coarse blocky structure; very firm when moist, nonsticky and nonplastic when wet; pH 5.6; diffuse, irregular lower boundary. 30 to 45 inches thick.

B'x3—68 to 80 inches +, dark grayish-brown (2.5Y 4/2) very channery loam to sandy loam; 50 percent coarse fragments; massive to strong, coarse, blocky structure; firm when moist, nonsticky and nonplastic when wet; pH 6.0. 12 to 24 inches thick.

Depth to the fragipan ranges from 15 to 30 inches. Varying amounts of stones and boulders are on the surface and in the solum.

Mardin soils are associated with the well drained Swartswood soils, the moderately well drained Wurtsboro soils, the moderately deep Manlius soils, the somewhat poorly drained or poorly drained Volusia soils, and the very poorly drained Tughill soils. They are similar to Culvers soils but have a yellowish-brown to olive-brown solum. The solum of the Culvers soils is reddish or brown. Mardin soils are similar to the Wurtsboro soils but are finer textured and silty rather than sandy.

The Mardin soils associated with Manlius soils in the eastern part of the county have a higher proportion of silt throughout the profile than do the Mardin soils associated with Swartswood soils in the central part of the county.

**Mardin channery silt loam, 2 to 8 percent slopes, moderately eroded** (MnB2).—This soil has a profile similar to the one described for the series, but it has a surface layer of channery silt loam, is less stony, and has been cultivated. The surface layer has been mixed into the plow layer, and about 4 inches or more have been lost through erosion. Included in the mapping of this soil were small areas of an uneroded soil in wooded areas and in some nearly level places.

The major limitations of this Mardin soil are the fragipan, which causes the seasonal high water table, and the slope, which produces an erosion hazard. The soil is suited to most crops grown in the county, except those that are sensitive to a seasonal high water table. When crops are grown, the rotation should be one of medium intensity. Conservation practices are needed to reduce erosion and to

carry away surface water. (Capability unit IIw–1; woodland suitability group 6)

**Mardin channery silt loam, 8 to 15 percent slopes, moderately eroded** (MnC2).—This soil has a profile similar to the one described for the series. The present plow layer in most places is a mixture of the remaining surface soil and the yellowish-brown subsoil. Included in the mapping of this soil were small areas of an uneroded soil in woods.

This Mardin soil is sloping and is moderately well drained. Risk of erosion is the major limitation. The soil is suited to most crops grown in the area, except those sensitive to a high water table. When crops are grown, the rotation should be one of low intensity. The fragipan and the seasonal high water table are limiting factors when the soil is used for building sites. (Capability unit IIIe–2; woodland suitability group 6)

**Mardin very stony loam, 0 to 8 percent slopes** (MoB).—This soil has the typical profile that is described for the Mardin series. Stones and boulders cover 3 to 15 percent of the surface. Most areas have not been cultivated.

This soil is nearly level to gently sloping and is moderately well drained. There is very little if any erosion. Stones are the major limitation. The soil is suited to pasture, trees, and wildlife habitats. It can be used for extensive pasture if the level of management is high. The stones make cultivation impractical and are a moderate limitation for building sites. (Capability unit VIs–1; woodland suitability group 6)

**Mardin very stony loam, 8 to 25 percent slopes** (MoC).—This soil has a profile similar to the one described as typical for the Mardin series. Stones and boulders cover 3 to 15 percent of the surface. Most areas have not been cultivated. A few areas of a strongly sloping channery silt loam were included in mapping.

This Mardin soil is sloping or moderately steep and is moderately well drained. Stones and slopes are the major limitations. There is very little if any erosion, since nearly all the areas are wooded. The soil is suited to pasture, trees, and wildlife habitats. The stones make cultivation impractical. The strong slopes make the soil unsuited to use for large buildings, and the many stones are a moderate to severe limitation for homesites. (Capability unit VIs–1; woodland suitability group 6)

## Middlebury Series

The Middlebury series consists of deep, moderately well drained and somewhat poorly drained, loamy soils formed in brownish to reddish alluvial sediments on flood plains.

Middlebury soils have a seasonal high water table and are flooded occasionally. They have moderate to high available moisture capacity and rapid permeability. They are moderately acid.

Most of these soils are in pasture or forest. Plants that are sensitive to a high water table generally do not grow well. The high water table limits the soils moderately for use as building sites.

A typical Middlebury soil in a cultivated field has a dark-brown loam plow layer about 8 inches thick. This layer is mellow and easily tilled. The upper subsoil is dark-brown, friable loam to a depth of 15 inches. The main part of the subsoil is light-brown, friable loam that has streaks and spots of strong brown and gray. Below a depth of 28 inches the substratum is light-brown loam that has many mottles of gray and strong brown. Some layers have in them lenses of sand and gravel.

Profile of Middlebury loam south of Dingmans Ferry in a cultivated field:

Ap—0 to 8 inches, dark-brown (7.5YR 4/2) loam; moderate, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 5.6; abrupt, smooth lower boundary. 6 to 10 inches thick.

B1—8 to 15 inches, dark-brown (7.5YR 4/4) loam; weak, medium, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 5.4; gradual, wavy lower boundary. 6 to 9 inches thick.

B21—15 to 28 inches, light-brown (7.5YR 6/4) loam; few, medium, distinct, strong-brown (7.5YR 5/8) and gray (N 6/1) mottles; weak, medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; pH 5.2; gradual, wavy lower boundary. 12 to 15 inches thick.

C—28 to 42 inches +, light-brown (7.5YR 6/4) loam; many, medium, distinct, gray (N 6/0) and strong-brown (7.5YR 5/8) mottles; weak, coarse, subangular blocky structure breaking to single grain; friable when moist, nonsticky and nonplastic when wet; pH 5.4. 14 to 24 inches thick.

Depth to mottling ranges from 12 to 30 inches. The texture ranges from silt loam through loam to sandy loam. Numerous pebbles and shale fragments are in the soil in places where drainageways meet the flood plain.

Middlebury soils are closely associated with the well-drained Tioga soils and the poorly drained Holly soils. Also nearby are areas of Chenango and of Tunkhannock soils. Middlebury soils are similar to Tioga soils but are not so well drained.

**Middlebury loam** (Mr).—This soil has the profile that is described as typical for the Middlebury series. It is nearly level. Included in the mapping of this soil were a few small areas of a similar silt loam soil and of a more sandy soil.

If drained, this Middlebury soil is suited to most crops grown in the area. Plants sensitive to a seasonal high water table usually are winterkilled. Flooding is a severe limitation for building sites on this soil. (Capability unit IIw–1; woodland suitability group 3)

## Morris Series

The Morris series consists of deep, somewhat poorly drained to poorly drained, loamy soils that were formed in glacial till derived from a mixture of red and gray, acid sandstone and shale. These soils are nearly level to sloping and are on uplands. Slopes are generally concave.

Morris soils have a firm fragipan, about 15 inches below the surface, that slows movement of water and retards growth of roots. They are very strongly and extremely acid. These soils have a seasonal high water table that makes them poorly suited to crops or to use for building sites.

A typical Morris soil in a wooded area has a 5-inch, dark grayish-brown, loam surface layer that is about 25 percent coarse fragments. Above the mineral soil is a thin layer of leaves and twigs over a layer of very dark brown, fibrous organic material. Beneath the surface layer, to a depth of about 8 inches, is brown channery loam that is friable when moist. Between 8 and 15 inches, there is pinkish-gray, friable channery loam that has distinct, light-brown and gray mottling. The fragipan begins at 15 inches and extends to 60 inches. The upper part of the fragipan is firm, brown loam that has common, distinct, gray mottles. The lower part of the fragipan is reddish-gray, very firm channery loam that has mottles and streaks of gray and light brown.

Profile of Morris very stony loam, 0 to 8 percent slopes, near Blooming Grove in a wooded area:

O1—1½ inches to 1 inch, dark reddish-brown (5YR 3/3) leaf litter.

O2—1 inch to 0, very dark brown (10YR 2/2) humus held together in a tough, fibrous mat.

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) channery loam; 25 percent coarse fragments; moderate, medium, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.8; clear, wavy lower boundary. 4 to 7 inches thick.

B2—5 to 8 inches, brown (7.5YR 4/4) channery loam; 20 percent coarse fragments; moderate, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.6; clear, wavy lower boundary. 4 to 9 inches thick.

A'2g—8 to 15 inches, pinkish-gray (7.5YR 6/2) channery loam; common, medium, distinct, light-brown (7.5YR 6/4) and gray (N 5/0) mottling; 20 percent coarse fragments; weak, medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; pH 4.8; clear, wavy lower boundary. 4 to 8 inches thick.

B'x1—15 to 42 inches, brown (7.5YR 4/4) loam; common, medium, distinct, gray (N 6/0) mottles; 15 percent coarse fragments; moderate, coarse, prismatic breaking to weak, medium, platy and blocky structure; firm when moist, slightly sticky and slightly plastic when wet; pH 5.4; diffuse, irregular lower boundary. 25 to 30 inches thick.

B'x2g—42 to 60 inches +, reddish-gray (5YR 5/2) channery loam; streaks of gray (N 6/0) and light brown (7.5YR 6/4); 25 percent coarse fragments; moderate, coarse, prismatic breaking to strong, thick, platy and coarse blocky structure; very dark gray (N 3/0) coatings and concretions; very firm when moist, slightly sticky and nonplastic when wet; pH 5.6. 18 to 25 inches thick.

Depth to the Bx horizon ranges from 10 to 18 inches. Color of the B horizon ranges from brown to yellowish brown.

Morris soils are associated closely with the deep, well drained Cattaraugus soils, the moderately well drained Culvers soils, and the very poorly drained Norwich soils. They are also associated with the Oquaga, Volusia, and Tughill soils. They contain a fragipan and have about the same degree of natural drainage as Volusia soils but are reddish brown or brown instead of the yellowish brown to olive typical of Volusia soils.

**Morris channery loam, 3 to 8 percent slopes, moderately eroded** (MsB2).—This soil has a profile similar to the one described as typical for the series, but it is not so stony, and it has been farmed. Plowing has mixed the upper layers, and some soil material has been lost through erosion, so that the plow layer now consists of a mixture of the former surface soil and some subsoil. Included in mapping this soil were some small areas of a channery soil that are nearly level to moderately sloping. Also included were some areas of this soil that are wooded and are uneroded.

Seasonal wetness and the hazard of erosion are major limitations of this Morris soil. The soil is fairly well suited to farming. A crop rotation of low intensity should be followed, and moisture-tolerant crops should be grown. Conservation practices are needed to control erosion and to remove excess surface and subsurface water. The seasonal high water table is a severe limitation for building sites. (Capability unit IIIw–1; woodland suitability group 13)

**Morris very stony loam, 0 to 8 percent slopes** (MtB).—This soil has the profile described as typical for the Morris series. Stones and boulders cover 3 to 15 percent of the surface. Most of the area is in forest.

This soil is nearly level or gently sloping, and there is little or no erosion. The soil is so stony and wet that it is not suited to cultivated crops. It is suited to trees and wildlife habitats. The stones make logging difficult. The stones and the seasonal high water table limit this soil severely for building sites. (Capability unit VIIs–1; woodland suitability group 13)

**Morris very stony loam, 8 to 15 percent slopes** (MtC).—This soil has a profile similar to the one described as typical for the Morris series. Stones and boulders cover 3 to 15 percent of the surface. This soil has not been cultivated, and most of it is wooded.

There is not much erosion under the cover of trees. The stones and the seasonal high water table are severe limitations, but this soil can be used for trees, wildlife, and recreation. (Capability unit VIIs–1; woodland suitability group 13)

## Muck

Muck (Mu) consists of finely divided, partly decomposed organic material that was derived from woody shrubs, grasses, sedges, sphagnum moss, and other plants. This material has collected in closed depressions that contain water most of the time. Many areas in which Muck occurs were originally small lakes or ponds that gradually filled with vegetation and silt from the edges toward the center. In their natural state, they are covered with grasses, shrubs, or trees.

Muck is formed by biological and chemical changes occurring mostly above the water table. In most places it has crumb structure and contains soluble brown acids.

A typical Muck soil in this county has a black, granular upper layer that feels silty when rubbed. The upper layer is about 24 inches thick and consists of partly decomposed organic matter. The plant material has been broken into small particles that cannot be identified individually. From 24 to 42 inches is a layer of dark reddish-brown, partly decomposed woody material in which the original structure of the plant material can be identified. Between 42 and 72 inches, there is very dark gray, slightly sticky, disintegrated organic material. These organic layers lie over gray, silty, mineral soil material that contains varying amounts of stones and boulders. The thickness of the organic material ranges from 3 feet to 10 feet or more.

Profile of Muck south of Cliff Park:

O1—0 to 24 inches, black (10YR 2/1) silty muck; weak, medium, granular structure; sticky and plastic when wet; pH 4.4; pyrophosphate test more than 2 percent; clear, smooth lower boundary. 20 to 30 inches thick.

O2—24 to 42 inches, dark reddish-brown (5YR 3/2) woody peat; nonsticky and nonplastic when wet; pH 4.2; pyrophosphate test three-quarters of a percent; diffuse lower boundary. 12 to 36 inches thick.

O3—42 to 72 inches, very dark gray (10YR 3/1) disintegrated peat; slightly sticky and slightly plastic when wet; pH 4.4; pyrophosphate test less than one-quarter of a percent; abrupt, smooth lower boundary. 24 to 36 inches thick.

II—72 inches +, gray (10YR 5/1) silty substratum; pH 4.4.

Depth ranges from 3 feet to 10 feet or more.

Muck is associated with Peat and with the other soils common to the depressions.

Muck, when cleared, drained, and managed properly, is a valuable soil for vegetables or specialty crops. The major

limitations in its natural state are the high water table and the subsidence that takes place with drainage. Muck is suited to wildlife habitats and scenic areas and to studies of wetland biology. It is not suitable for building sites, because of subsidence and poor stability, and it must be removed or displaced when roads or other embankments or structures are built. (Capability unit VIIw–1; woodland suitability group 17)

## Norwich Series

The Norwich series consists of deep, very poorly drained, silty soils that were formed in glacial till derived from mixed red and gray, acid sandstone and shale. These soils are on uplands, where they lie in drainageways and closed depressions and on concave slopes.

The Norwich are nearly level or gently sloping soils on concave slopes and are subject to ponding of surface water during winter and early in spring. They have slow permeability because of a well-developed fragipan, and their position prevents drainage. These soils are too wet and stony for cultivated crops. They are moderately acid. Most areas are wooded or are used as pasture. The excess water and the stones are severe limitations for use of the soils as building sites.

A typical Norwich soil in an open, wooded area has a very dark gray, friable channery silt loam surface layer that is streaked with rust. This layer is about 9 inches thick. The upper subsoil, to a depth of about 15 inches, is dark-gray, firm channery silt loam that has mottles of light reddish brown and strong brown. A fragipan, below a depth of 15 inches, is brown channery silt loam that has dark-gray mottles and strong-brown streaks and splotches. This layer extends to about 42 inches, and it is underlain by firm glacial till of about the same colors.

Profile of Norwich very stony silt loam, 0 to 8 percent slopes, east of Salus Lake in a wooded area:

A1—0 to 9 inches, very dark gray (N 3/0) channery silt loam; numerous rust streaks; 25 percent coarse fragments; moderate, medium, granular structure; friable when moist, slightly sticky and plastic when wet; pH 5.8; clear, smooth lower boundary. 8 to 12 inches thick.

B2g—9 to 15 inches, dark-gray (N 4/0) channery silt loam; common, medium, distinct, light reddish-brown (5YR 6/4) and strong-brown (7.5YR 5/8) mottling; 20 percent coarse fragments; weak, coarse, blocky structure; firm when moist, sticky and plastic when wet; pH 5.6; clear, smooth lower boundary. 3 to 7 inches thick.

Bx1g—15 to 36 inches, brown (7.5YR 5/2) channery silt loam; common, medium, distinct, dark-gray (N 4/0) and strong-brown (7.5YR 5/8) mottling; 20 percent coarse fragments; weak, thick, platy breaking to blocky structure; firm when moist, sticky and slightly plastic when wet; pH 5.8; gradual, smooth lower boundary. 18 to 25 inches thick.

Bx2g—36 to 42 inches +, brown (7.5YR 5/2) channery loam; common, coarse, distinct, dark-gray (N 4/0) and strong-brown (7.5YR 5/8) mottling; 40 percent coarse fragments; massive to weak, medium, blocky and platy structure; very firm when moist, slightly sticky and nonplastic when wet; pH 6.0.

The color hue ranges from 5YR to 10YR, depending on the proportions of red and gray in the parent material. Some areas have a thin layer of alluvial sediments on the surface.

Norwich soils are closely associated with the somewhat poorly drained Morris and Volusia soils and the very poorly drained Tughill soils. Peat and Muck soils are near many of the areas. Norwich soils are similar to the Tughill soils but are brownish rather than dark gray and olive.

**Norwich channery silt loam, 0 to 3 percent slopes** (NoA).—This soil has a profile similar to the one described as typical for the Norwich series, although the surface layer in some places is lighter in color. Many of the areas are nearly level and in closed depressions or drainageways where water from surrounding slopes tends to collect on the surface. Normally, some local alluvium is deposited from time to time on the surface.

Wetness is the major limitation. There is little or no erosion, since the soil is nearly level or concave.

This soil is poorly suited to cultivated crops. Crops that tolerate wetness can be grown in a rotation of very low intensity. Conservation practices that remove subsurface water will improve growth of crops and make management easier. This soil is better suited to pasture or trees than to field crops. The high water table limits this soil severely for building sites. (Capability unit IVw–1; woodland suitability group 16)

**Norwich very stony silt loam, 0 to 8 percent slopes** (NrB).—This soil has the typical profile described for the Norwich series. It is in depressions and on concave slopes and is poorly drained or very poorly drained. Stones and boulders cover 3 to 15 percent of the surface. This soil has not been cultivated, and most of it is wooded. In thick forests the surface is covered with leaves and an organic mat.

Stones and poor drainage are the major limitations. There is no erosion, since the soil is nearly level or gently sloping. This soil is better suited to trees and wildlife habitats than to cultivated crops. Most of the areas are too wet and too stony for use as building sites. (Capability unit VIIs–1; woodland suitability group 16)

## Oquaga Series

The Oquaga series consists of moderately deep to deep, well-drained soils underlain by loosened and broken bedrock. These soils formed in thin glacial till or in residuum that was derived from mixed, acid, red and gray sandstone and shale. Most Oquaga soils are in the western part of the county. Some are gently sloping on the glacially scraped ridgetops. Most of the areas, however, are strongly sloping to steep and are on escarpments along the major streams.

Oquaga soils are extremely to strongly acid. They have low to very low available moisture capacity, rapid permeability throughout the profile, and generally rapid surface runoff.

A typical Oquaga soil in woodland has a thin layer of leaf litter over a 2-inch organic mat. Below this organic horizon is a thin, black surface layer of mineral soil and a thin, pinkish-gray, channery loam subsurface layer that is friable or loose. The upper subsoil is reddish-brown channery loam that extends to a depth of about 16 inches. The main part of the subsoil, extending to about 28 inches, is light-brown, friable channery loam. The substratum is brown very channery loam that is about 75 percent coarse fragments and is underlain by bedrock.

Profile of an Oquaga channery loam north of Skytop in a wooded area:

O2—2 inches to 0, very dark brown (10YR 2/2) humus held together in a mat by fine roots; abrupt, wavy lower boundary. 1 to 3 inches thick.

A2—0 to 1 inch, pinkish-gray (7.5YR 6/2) channery loam; 25 percent coarse fragments; weak, fine, granular structure; friable when moist; pH 4.2; clear, wavy lower boundary. 0 to 2 inches thick.

B1—1 inch to 16 inches, reddish-brown (5YR 5/4) channery loam; 30 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.4; gradual, wavy lower boundary. 12 to 18 inches thick.

B2—16 to 28 inches, light-brown (7.5YR 6/4) channery loam; 45 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.4; diffuse, smooth lower boundary. 10 to 15 inches thick.

C—28 to 40 inches, brown (7.5YR 5/4) very channery loam; 75 percent coarse fragments; weak, fine, granular structure; some single grain; friable when moist, nonsticky and nonplastic when wet; pH 4.4. 12 to 20 inches thick.

Depth to bedrock ranges from 20 to 40 inches but in most places is between 20 and 30 inches. Color of the soil ranges from brown to reddish brown and varies with the amount of red shale and sandstone in the parent material. The volume of the solum occupied by stones and boulders ranges from 15 to 50 percent and is greatest on the steep slopes.

Oquaga soils are associated with the deep, well drained Cattaraugus soils, the moderately well drained Culvers soils, the somewhat poorly drained to poorly drained Morris soils, and the very poorly drained Norwich soils. They resemble the Manlius soils but have a light-brown to reddish-brown solum rather than one that is grayish to yellowish brown.

**Oquaga channery loam, 3 to 12 percent slopes, moderately eroded** (OaB2).—This soil has a profile similar to the one described as typical for the Oquaga series. Most areas are cultivated, and the surface layers have been mixed to form a plow layer. The present surface layer is lighter in color than the B1 horizon described. The soil in most places has lost several inches through erosion.

This soil has low moisture-holding capacity and tends to be droughty. The risk of further erosion is a limitation. This soil is fairly well suited to cultivated crops but should be farmed in a crop rotation of low intensity that is supported by conservation measures to control erosion. The slope and the limited depth to rock are moderate limitations for use of this soil as building sites. (Capability unit IIIe–1; woodland suitability group 11)

**Oquaga extremely stony loam, 0 to 12 percent slopes** (OeB).—This soil has a profile similar to the one described as typical for the Oquaga series. Stones and boulders cover 15 to 50 percent of the surface. Most of the areas are in woods.

This soil is well drained and is nearly level to strongly sloping. There is very little if any erosion. It is best suited to trees and wildlife habitats. The stones make cultivation impractical and make logging difficult. (Capability unit VIIs–1; woodland suitability group 11)

**Oquaga extremely stony loam, 12 to 30 percent slopes** (OeD).—This soil has a profile similar to the one described as typical for the Oquaga series. Stones and boulders, however, cover 15 to 50 percent of the surface. Most areas have not been cleared. The soil is well drained.

Stones are the major limitation. They make cultivation impractical and logging difficult. This soil is suited to trees and wildlife habitats. The strong slope makes construction of large buildings impractical. (Capability unit VIIs–1; woodland suitability group 11)

**Oquaga extremely stony loam, 30 to 80 percent slopes** (OeF).—This soil has a profile similar to the one described as typical for the series. It is steep or very steep and has 15 to 50 percent of the surface covered by stones and boulders. Most areas have not been cleared, because of the slope and the stones. A few areas of steep channery loam soils were included in mapping this soil.

Steep slopes and stones are the major limitations of this Oquaga soil. They make cultivation impractical and logging difficult. This soil is suited only to trees. The steep and very steep slopes make it generally undesirable for building sites. (Capability unit VIIs–1; woodland suitability group 12)

**Oquaga very stony loam, 0 to 12 percent slopes** (OvB).—This soil has the profile described as typical for the Oquaga series. Stones and boulders cover 3 to 15 percent of the surface. The soil is well drained and is nearly level to sloping. It has not been cultivated, because of the cost of removing the trees and stones. There is no erosion.

Stones are the major limitation. This soil is suited to pasture but may be used for trees and for wildlife habitats. The stones make cultivation impractical and pasture management difficult. (Capability unit VIs–1; woodland suitability group 11)

**Oquaga very stony loam, 12 to 30 percent slopes** (OvD).—This soil has a profile like the one described for the Oquaga series. It is sloping and moderately steep and has 3 to 15 percent of the surface covered by stones and boulders. It has not been cultivated, because of the high cost of clearing the land. A few areas of strongly sloping channery loam soils were included in mapping this soil.

Stones are the major limitation, and they make cultivation impractical on this Oquaga soil. This soil is suited to pasture and may be used for trees and for wildlife habitats. The strong slopes make construction of large buildings impractical. (Capability unit VIs–1; woodland suitability group 11)

## Papakating Series

The Papakating series consists of deep, very poorly drained, silty soils that were formed in brown to reddish-brown alluvial deposits. Most of these soils are in the central part of the county on flood plains along the smaller streams.

The Papakating soils have a seasonal high water table, moderate to high available moisture capacity, and very slow permeability through the profile. They are subject to very frequent flooding and ponding. In places beavers have dammed the streams.

These soils are too wet for cultivation unless they are drained. They are suitable for extensive pasture, for trees, or for wildlife habitats. Most of the acreage is in woods or pasture. The soils are too wet and unstable for building sites.

A typical Papakating soil in an idle area has a surface layer of very dark gray silt loam that is streaked with gray and yellowish brown. It is friable and easily tilled. This layer in most places is about 9 inches thick. The subsoil is gray heavy silt loam that has strong-brown and olive-brown streaks and splotches. The substratum is gray silty clay loam that has common, medium, distinct, strong-brown and olive-brown mottles. This layer is firm. It extends to more than 42 inches. Some lower layers are sand and gravel.

Profile of Papakating silt loam south of Shohola Falls in an idle field:

A1—0 to 9 inches, very dark gray (10YR 3/1) silt loam; common, fine, distinct, gray (10YR 5/1) and yellowish-brown (10YR 5/4) mottling; moderate, medium, granular structure; friable when moist, slightly sticky and plastic when wet; pH 5.6; clear, smooth lower boundary. 6 to 10 inches thick.

B2g—9 to 18 inches, gray (10YR 5/1) heavy silt loam; common, medium, distinct, strong-brown (7.5YR 5/6) and olive-brown (2.5Y 4/4) mottling; strong, medium, blocky structure; firm when moist, sticky and plastic when wet; pH 5.2; diffuse, smooth lower boundary. 7 to 10 inches thick.

Cg—18 to 42 inches +, gray (5Y 5/1) silty clay loam; common, medium, distinct, olive-brown (2.5Y 4/4) and strong-brown (7.5YR 5/6) mottling; massive; firm when moist, sticky and plastic when wet; pH 4.8. 24 to 36 inches thick.

Color of the surface soil ranges from gray to black, Gravel and shale fragments are in the soil where drainageways enter the flood plain.

Papakating soils are closely associated with the poorly drained Holly soils, the moderately well drained and somewhat poorly drained Middlebury soils, and the well drained Tioga soils. Areas of Peat, Muck, and Stony and cobbly alluvial land are nearby.

**Papakating silt loam** (Pa).—This soil has the profile described as typical for the Papakating series. Wetness is its major limitation. The soil is nearly level and is usually covered with water during spring. Few areas have outlets adequate for drainage. This soil is too wet for cultivated crops, but it is suited to extensive pasture. It is too wet and is flooded too often to be used for building sites. (Capability unit VIw-1; woodland suitability group 5)

## Peat

Peat consists of deep, very poorly drained, organic soils that were formed in the debris from swamp vegetation. These soils are in swampy areas of the Allegheny Plateau.

Peat is composed of the remains of leaves, roots, and stems of sphagnum moss, grasses, sedges, rushes, and woody plants. The materials are preserved in swamps, ponds, or lakes where they have accumulated under water. The water prevents normal decomposition of the plant remains. Frequently more than half of the plant material can be identified.

Some peats have been formed from plant materials that were broken up by movement due to wind and waves, by the digestion of animals, or by hydrolysis due to bacterial or fungal enzymes. These peats, which consist of finely divided materials derived from plants and animals, are called disintegrated peats.

Peat is valuable for the production of vegetables or specialty crops after it has been cleared and drained, provided it is managed properly. The major limitations for farming are the high water table and the subsidence that takes place with drainage. The material is not suitable for building sites and must be removed or displaced when roads or other embankments or structures are built.

A typical Peat profile has 22 inches of dark reddish-brown woody peat. This layer is underlain by black disintegrated peat. The thickness of the black layer ranges from 3 to 18 feet or more. The black layer is underlain by bluish-gray sandy loam or gray silty clay loam.

Profile of Peat on a quaking bog at Salus Lake in a wooded area:

O1—0 to 2 inches, reddish-brown (5YR 4/3) woody peat; pH 3.8; pyrophosphate test less than one-fourth percent; diffuse lower boundary.

O2—2 to 8 inches, dark reddish-brown (5YR 2/2) woody peat; pH 4.6; pyrophosphate test less than one-fourth percent; diffuse lower boundary.

O3—8 to 22 inches, dark reddish-brown (5YR 3/2) woody peat; pH 5.8; pyrophosphate test less than one-fourth percent; clear, smooth lower boundary.

O4—22 to 70 inches, black (5YR 2/1) disintegrated peat; sticky and plastic when wet; pH 6.8; pyrophosphate tests less than one-fourth percent; diffuse lower boundary.

O5—70 to 192 inches, black (5YR 2/1) disintegrated peat; pH 7.0; pyrophosphate test less than one-fourth percent; abrupt, smooth lower boundary.

IIC—192 inches +, gray (N 5/0) silty clay loam; massive; pH 6.0.

Depth to bedrock ranges from 4 to 18 feet or more. Depth to the sticky, plastic, disintegrated peat is in most places less than 3 feet, and depth to the semifluid material is generally more than 4 feet. The semifluid material is under pressure and may rise to the surface as "bog-bursts."

Peat is associated with Muck, with the poorly drained Holly soils, and with the very poorly drained Norwich, Tughill, Atherton, and Papakating soils.

**Peat** (Pe).—Peat consists of partly decomposed organic material that occurs in level swampy areas and in closed depressions or ponds. The peat in these places ranges in thickness from 3 to 18 feet or more.

In its natural state most Peat is not suitable for cultivation, because of the high water table. When drained, cleared, fertilized, and properly managed, this soil becomes highly productive for vegetable crops. The material is not suitable for building sites and must be removed or displaced when roads, embankments, or other structures are built. (Capability unit VIIw-1; woodland suitability group 17)

**Peat, shallow** (Ps).—This material is similar to Peat, except that the mineral soil material lies 2 to 4 feet below the surface and the semifluid peat is absent. The brown, fibrous material is 12 to 18 inches thick, and the dark, disintegrated layer is 30 to 36 inches thick. In some places large boulders are in this soil. Because control of water is difficult, Peat, shallow, is not so well suited to farming as the deeper deposits.

The major limitations are the high water table and the subsidence that takes place with drainage. This soil is not suitable for building sites, and the peat must be removed or displaced when roads, embankments, or other structures are built. (Capability unit VIIw-1; woodland suitability group 17)

## Red Hook Series

The Red Hook series consists of deep, somewhat poorly drained soils that were formed in grayish, sandy and gravelly glacial outwash. These soils are in nearly level to concave areas on stream terraces along the major stream valleys and in small depressions in the uplands.

Red Hook soils have slow permeability; their available moisture capacity is low to moderate. The soils are moderately acid.

A typical Red Hook soil in a cultivated field has a dark grayish-brown loam surface soil that is about 5 percent gravel. This easily tilled layer is 7 inches thick. The upper subsoil is friable, brown loam that has medium-sized pale-brown and yellowish-brown mottles. It extends to about 18

inches. The lower subsoil is brown gravelly loam that has common, coarse, distinct, gray and yellowish-brown mottles and is about 25 percent gravel. This material extends to 36 inches. Below 36 inches, the substratum is dark grayish-brown sandy loam and gravelly loam that has very dark brown coatings and concretions. It extends to 42 inches or more and in many places is stratified.

Profile of Red Hook loam north of Milford in a cultivated field:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loam; 5 percent coarse sand and gravel; moderate, medium, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 5.8; abrupt, smooth lower boundary. 6 to 8 inches thick.

B21—7 to 18 inches, dark-brown (10YR 4/3) loam; common, medium, distinct, pale-brown (10YR 6/3) and yellowish-brown (10YR 5/8) mottles; 15 percent coarse sand and gravel; weak, medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; pH 5.4; clear, smooth lower boundary. 8 to 15 inches thick.

B22—18 to 36 inches, brown (10YR 5/3) gravelly loam; common, coarse, distinct, gray (10YR 6/1) and yellowish-brown (10YR 5/8) mottles; 25 percent coarse sand and gravel; massive and single grain; firm when moist, nonsticky and nonplastic when wet; pH 5.0; gradual, smooth lower boundary. 15 to 20 inches thick.

IIC—36 to 42 inches +, dark grayish-brown (10YR 4/2) sand and gravel; very dark brown (10YR 2/2) coatings and concretions; 50 percent coarse sand and gravel; single grain; loose when moist, nonsticky and nonplastic when wet; pH 5.0. 6 to 24 inches thick.

Depth to the B22 horizon ranges from 12 to 25 inches; the depth to mottling ranges from 10 to 20 inches.

Red Hook soils are closely associated with the poorly drained and very poorly drained Atherton soils, the moderately well drained Braceville soils, and the deep, well drained Chenango and Tunkhannock soils.

**Red Hook loam** (Rh).—This soil has the profile that is described as typical for the Red Hook series. It is nearly level. Water from surrounding slopes tends to collect on the level areas and concave slopes.

Wetness is the major limitation of this soil. There is little or no erosion. This soil is suited to most crops grown in the area if the crops are grown in a rotation of low intensity and practices are applied to remove excess water. This soil is too wet for desirable building sites. (Capability unit IIIw–1; woodland suitability group 8)

## Riverwash

Riverwash (Rv) is a miscellaneous land type that consists of gravelly, cobbly, and sandy materials on islands, deltas, and beaches along the Delaware River and the Lackawaxen River. These materials are so young that soil horizons have not yet been formed. Stream action removes and deposits material and damages or destroys plants.

Depth to the water table is generally controlled by the height of the water level in the stream. Very frequent flooding is the major problem on this land type.

The hazards are so severe that these areas should be used only for recreation or wildlife habitat development. They are not suited to crops or for use as building sites. (Capability unit VIIIs–1; woodland suitability group 17)

## Rushtown Series

The Rushtown series consists of deep, well-drained soils formed in deposits of acid, gray, shale fragments at the base of steep slopes. Most of these areas are at the foot of the bluffs along the Delaware River.

Most of the Rushtown soils are steep and for that reason have been left in woods. They contain such a large amount of coarse fragments that they have low available moisture capacity and rapid permeability. Most of the shale chips in the lower subsoil and the substratum are arranged parallel to one another.

These soils have moderate to severe limitations when used for cultivated crops because of their slope and low water-holding capacity. They are very strongly acid. The steep slopes and the unconsolidated substratum are severe limitations for building sites.

A typical Rushtown soil in woods has a dark grayish-brown silt loam surface layer that is about 75 percent shale fragments. This layer is about 7 inches thick. The next layer (upper substratum) is yellowish-brown very shaly silt loam. It is 95 percent shale fragments, and the fragments have coatings of silt and clay. This layer extends to a depth of 42 inches. The lower substratum is dark-gray shale fragments that are loose or are weakly cemented by silt and clay particles. Generally, this material overlies bedrock at a depth of 3 feet to 18 feet or more.

Profile of a Rushtown very shaly silt loam northeast of Egypt Mills in a wooded area:

A1—0 to 7 inches, dark grayish-brown (10YR 4/2) very shaly silt loam; 75 percent shale fragments; weak, fine, granular structure; loose when moist, nonsticky and nonplastic when wet; pH 4.8; gradual, wavy lower boundary. 5 to 10 inches thick.

C1—7 to 18 inches, yellowish-brown (10YR 5/4) shale fragments; slightly cemented with silt and clay; single grain; friable when moist, nonsticky and nonplastic when wet; pH 4.4; diffuse lower boundary. 8 to 15 inches thick.

C2—18 to 42 inches, dark yellowish-brown (10YR 4/4) shale fragments; slightly cemented with silt and clay; single grain; firm when moist, nonsticky and nonplastic when wet; pH 4.8; diffuse lower boundary. 15 to 30 inches thick.

C3—42 to 72 inches, dark-gray (10YR 4/1) shale; single grain; loose when moist, nonsticky and nonplastic when wet; pH 5.6. 30 to 90 inches thick.

Depth to hard rock ranges from 3 feet to 18 feet or more. The amount of shale ranges from 40 to 80 percent in the A1 horizon and from 80 to 99 percent in the C horizon.

Rushtown soils occur between the Chenango, Tioga, and Middlebury soils of the terraces and flood plains and the Manulius, Dekalb, and other soils close to the bluffs.

**Rushtown very shaly silt loam, 25 to 45 percent slopes** (RwE).—This soil has the profile described as typical for the Rushtown series (fig. 6). The surface material tends to move downslope when disturbed by nature or by man.

Droughtiness and steep slopes are the major limitations of this soil. The soil is too steep for safe and efficient use of farm machinery, and it should be maintained in woods or in wildlife habitats. It is also too steep for building sites. (Capability unit VIIe–1; woodland suitability group 10)

## Stony and Cobbly Alluvial Land

Stony and cobbly alluvial land (Sc) is a miscellaneous land type that consists of deep, level or gently sloping deposits in streams and drainageways. The materials are well drained or moderately well drained sand, silt, gravel, and cobblestones. This land type is on flood plains and

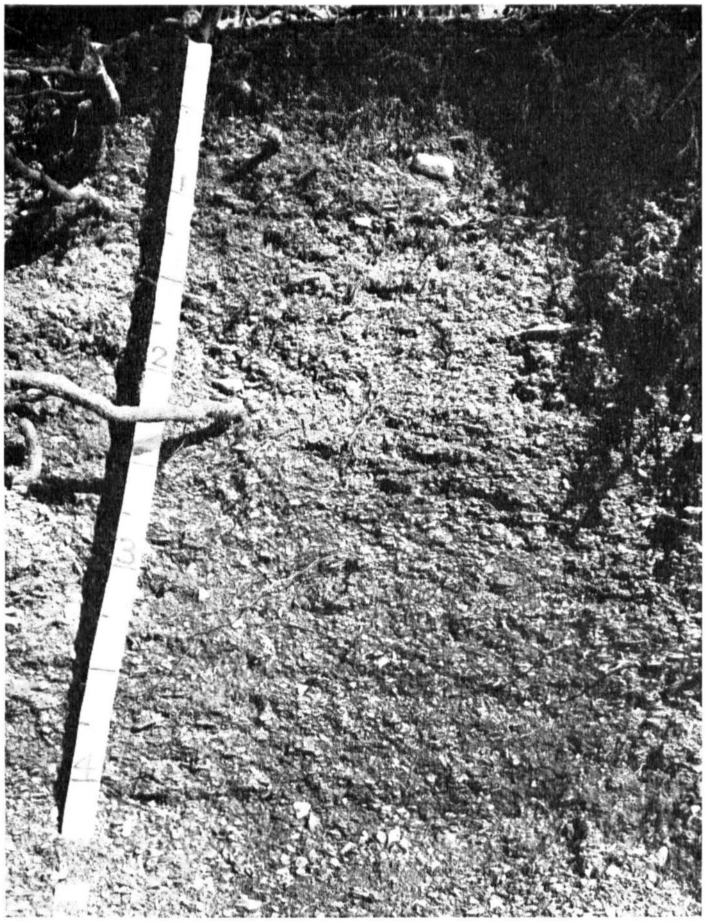

*Figure 6.*—**Typical profile of Rushtown very shaly silt loam, 25 to 45 percent slopes, in a cliff south of Milford. Shale chips in the lower subsoil and the substratum are roughly parallel. Numbers on tape indicate depth in feet.**

alluvial fans at the mouths of drainageways. Typically, the deposits are not old enough for soil horizons to have developed. This land type supports grass and shrubs and may be used for permanent pasture, but generally the areas are too stony to be managed intensively. Most areas of this land type are flooded too frequently to be used for building sites. (Capability unit VIs–2; woodland suitability group 17)

## Stony Land

Stony land occurs mainly along the escarpments facing the Delaware and the Lackawaxen Rivers and along their entrenched tributaries. The soil material is shallow over shale bedrock and is unstable; it moves downslope when disturbed, for example, by freezing and thawing. Exposed bedrock is shown on the soil map by symbols for rock outcrop.

The rock material of Stony land is acid, mostly gray shale and a few strata of sandstone. The shale along the Lackawaxen River escarpments is red. Colluvial debris from these steep slopes accumulates at the bottom to provide the parent material of the Rushtown soils. Most of the areas of Stony land consist of exposed stones and boulders.

**Stony land, moderately steep** (SmD).—This land type has a shallow soil profile that shows little or no horizon development. Bedrock usually lies slightly deeper below the soil surface than in Stony land, steep.

Droughtiness and steep slopes are the major limitations. This land type is best suited to trees and wildlife habitats. (Capability unit VIIIs–1; woodland suitability group 17)

**Stony land, steep** (SsF).—This land type is very shallow to bedrock. Droughtiness and steep slopes are major limitations. The land is best suited to development of wildlife habitats, hiking trails, and other recreational uses that are compatible with the steep and very steep slopes. The steep slopes make this land type generally undesirable for building sites or for agriculture. (Capability unit VIIIs–1; woodland suitability group 17)

## Swartswood Series

The Swartswood series consists of deep, well-drained, moderately coarse textured soils that were formed in glacial till derived from gray sandstone and siltstone. These soils are gently sloping to moderately steep and are on convex slopes of the uplands.

These soils have moderate available moisture capacity and moderate permeability. They are very strongly acid. Most of them are stony or channery. Most of the areas are wooded, but a few have been cultivated. The major limitations are the stones and the slopes.

A typical Swartswood soil in woods has a thin, gray sandy loam surface layer that has weak granular structure. In woods a thin layer of leaves and twigs and a thin black organic mat overlie the mineral soil. The subsurface soil is strong-brown sandy loam that has weak, granular structure and is about 15 percent coarse fragments. This layer extends to 7 inches. The subsoil is brownish-yellow to yellowish-brown gravelly sandy loam that is friable to a depth of 21 inches. Below 21 inches is a dark yellowish-brown to dark-brown gravelly sandy loam fragipan, very firm and brittle. The fragipan extends to a depth of 58 inches or more in some places.

Profile of Swartswood very stony sandy loam, 0 to 12 percent slopes, in woods, near Flat Ridge Road; sampled for characterization, Profile S64–Pa–52–4(1–7):

O1—2 inches to 1 inch, dark-brown (7.5YR 4/2) leaf litter, mostly oak; pH 4.0.

O2—1 inch to 0, black (10YR 2/1) leaf mold, roots, and fungus mycelia, held together in a tough, fibrous mat; pH 3.8.

A2—0 to 2 inches, gray (10YR 5/1) sandy loam; 15 percent coarse fragments; weak, fine, granular structure friable when moist, nonsticky and nonplastic when wet; pH 3.8; abrupt, wavy lower boundary. 1 to 3 inches thick.

B2ir—2 to 7 inches, strong-brown (7.5YR 5/6) sandy loam; 15 percent coarse fragments; weak, fine, granular structure; friable when moist nonsticky and nonplastic when wet; pH 4.5; clear, wavy lower boundary. 4 to 6 inches thick.

B21—7 to 12 inches, brownish-yellow (10YR 6/6) gravelly sandy loam; 20 percent coarse fragments; very weak, subangular blocky structure; friable when moist, slightly sticky and nonplastic when wet; pH 4.4; gradual, wavy lower boundary. 3 to 7 inches thick.

B22—12 to 18 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; 25 percent coarse fragments; weak, subangular blocky structure; friable when moist, slightly sticky and nonplastic when wet; pH 4.6; clear, wavy lower boundary. 4 to 8 inches thick.

B23—18 to 21 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; 15 percent coarse fragments; weak, medium, subangular blocky and platy structure; friable when moist, nonsticky and nonplastic when wet; pH 4.5; gradual, wavy lower boundary. 2 to 5 inches thick.

Bx1—21 to 37 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; some pockets of finer material that has a reddish hue; 20 percent coarse fragments; weak, medium, platy structure; few thin clay films in pores; firm in place, but sandy pockets less firm; nonsticky and nonplastic when wet; pH 4.5; gradual, wavy lower boundary. 14 to 24 inches thick.

Bx2—37 to 58 inches, dark-brown (7.5YR 4/4) gravelly sandy loam; bands of grayish-brown (10YR 5/2) gravelly sandy loam; 40 percent coarse fragments; weak, very thick, platy structure; few thin clay films in pores; very firm in place; nonsticky and nonplastic when wet; pH 4.6. 21 to 30 inches thick. Underlain by similar material.

Thickness of the solum ranges from 3 to 6 feet. The depth to hard rock ranges from 3½ feet to 20 feet or more. The fragipan is at a depth of 2 to 3 feet. The amount of coarse fragments in the solum ranges from 10 to 45 percent. Stones and boulders of sandstone, conglomerate, and quartzite are common on the surface and in the solum. Texture of the solum ranges from loam to sandy loam. Color of the A horizon has a hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 1 to 4. Color of the upper part of the B horizon is strong brown, dark brown, or dark reddish brown. Color of the lower part of the B horizon has a hue of 7.5YR to 2.5Y, value of 4 to 5, and chroma of 2 to 4. There are a few thin patches of clay films lining the pores in the B horizon and some clay bridges, but evidence of any appreciable amount of clay accumulation is lacking. Base saturation is less than 35 percent. The reaction is extremely acid or very strongly acid. A thin, spodic sequence of an A2 and a Bir horizon is present in the upper solum in most places where the soil has not been disturbed.

Swartswood soils are associated with the moderately well drained Wurtsboro soils, the somewhat poorly drained Volusia soils, and the moderately deep to deep, well drained Dekalb soils. They are similar to Cattaraugus soils but have a subsoil that is strong brown to yellowish brown rather than reddish brown.

**Swartswood channery sandy loam, 3 to 12 percent slopes, moderately eroded** (StB2).—This soil has a profile similar to the one described as typical for the series, but it is not stony, and it has been cultivated. Clearing and cultivation have mixed the organic layers with the upper mineral soil. Erosion has removed some of the surface soil, and the plow layer now lies on the upper or middle subsoil. Included in mapping this soil were small areas of a deep, well-drained, more silty soil on the plateau northwest of Bushkill.

Risk of further erosion is the major limitation of this Swartswood soil. The soil is suited to most crops common in the county. To conserve soil and moisture, crops should be grown in a rotation of medium intensity and long slopes should be protected by conservation practices. This soil has moderate limitations for use as building sites. (Capability unit IIe–1; woodland suitability group 9)

**Swartswood channery sandy loam, 12 to 20 percent slopes, moderately eroded** (StC2).—This soil has a profile similar to the one described for the Swartswood series. Most areas have been cultivated. The present plow layer in most places is a mixture of the remaining surface layer and the yellowish-brown subsoil. Included in mapping this soil were small areas of a well-drained silt loam on the plateau northwest of Bushkill.

This Swartswood soil is moderately steep, and risk of erosion is its major limitation. This soil is suited to most crops grown in the area. Crops should be grown in a rotation of low intensity, and conservation practices are needed to reduce erosion and conserve moisture. The slope limits this soil severely for use as building sites. (Capability unit IIIe–1; woodland suitability group 9)

**Swartswood very stony sandy loam, 0 to 12 percent slopes** (SwB).—This soil has the profile described as typical of the Swartswood series. Stones and boulders cover 3 to 15 percent of its surface. This soil is so stony that most of it has remained in forests.

Stones are the major limitation of this soil. There is little or no erosion hazard. This soil is suitable for pasture but generally cannot be managed intensively, because of the stones. Practical uses of this soil are for trees and for wildlife habitats. The stones are a moderate limitation for building sites. (Capability unit VIs–1; woodland suitability group 9)

**Swartswood very stony sandy loam, 12 to 30 percent slopes** (SwD).—This soil has a profile similar to the one described for the series. It is steeper than a typical Swartswood soil, however, and the profile in some places is somewhat thinner. Stones and boulders cover 3 to 15 percent of the surface. Most of this soil is in woods and has not been cleared.

Stones and slopes are the major limitations of this Swartswood soil. If the soil were cleared and farmed, erosion would be a hazard. The stones make cultivation difficult, but the soil will produce fairly good pasture. The moderately steep and steep slopes limit this soil severely for use as building sites. (Capability unit VIs–1; woodland suitability group 9)

## Tioga Series

The Tioga series consists of deep, well-drained, loamy and sandy soils that were formed in reddish-brown to brown sediments in the larger stream valleys. These soils are nearly level or gently sloping and are on flood plains and low terraces. Most of these soils are farmed, and they make up most of the land now used for crops in the county (fig. 7).

A typical Tioga soil in a cropped field has a dark-brown loamy fine sand surface layer that has weak, fine, granular structure. It is very easily tilled and has a thickness of about 13 inches. Below this layer there is little variation in the soil, except for slight differences in texture of the stratified deposits. The soil is mostly brown and dark-brown, friable very fine sandy loam, fine sandy loam, or loamy fine sand. A sample pit was dug to a depth of 154 inches, and the entire section was composed of nearly uniform material.

Profile of Tioga loamy fine sand, high bottom, 0 to 3 percent slopes, near Milford in a cultivated field: sampled for characterization, Profile S64–Pa–52–7(1–13) (described in special detail in connection with the characterization study):

Ap—0 to 13 inches, dark-brown (10YR 3/3) loamy fine sand; spots and streaks of darker colors; weak, fine, granular structure; very friable when moist, nonsticky and nonplastic when wet; pH 6.4; abrupt, wavy lower boundary. 12 to 14 inches thick.

C1—13 to 16 inches, brown (10YR 4/3) fine sandy loam; single grain; friable when moist, nonsticky and nonplastic when wet; pH 6.6; abrupt, irregular lower boundary. 2 to 4 inches thick.

*Figure 7.*—**Corn on a Tioga loamy fine sand along the Delaware River. The plants are about 4 inches high.**

C2—16 to 18 inches, dark-brown (10YR 3/3) to very dark grayish-brown (10YR 3/2) fine sandy loam; few darker and lighter splotches; single grain; friable when moist, nonsticky and nonplastic when wet; pH 7.0; abrupt, discontinuous lower boundary. 0 to 3 inches thick.

C3—18 to 21 inches, dark yellowish-brown (10YR 4/4) to brown (10YR 5/3) loamy fine sand; single grain; friable when moist, nonsticky and nonplastic when wet; pH 7.0; clear, wavy lower boundary. 2 to 4 inches thick.

C4—21 to 24 inches, brown (10YR 5/3) loamy fine sand; single grain; friable when moist, nonsticky and nonplastic when wet; pH 6.6; clear, wavy lower boundary. 2 to 5 inches thick.

C5—24 to 28 inches, brown (7.5YR 4/4) to reddish-brown (5YR 4/3) very fine sandy loam; single grain; friable when moist, nonsticky and nonplastic when wet; pH 6.8; clear, wavy lower boundary. 2 to 5 inches thick.

C6—28 to 35 inches, slightly redder than dark-brown (7.5YR 4/4) very fine sandy loam; single grain; friable when moist, nonsticky and nonplastic when wet; pH 7.0; gradual, wavy lower boundary. 5 to 9 inches thick.

C7—35 to 47 inches, redder than dark-brown (7.5YR 4/4) very fine sandy loam; single grain; friable when moist, nonsticky and nonplastic when wet; pH 6.9; clear, wavy lower boundary. 10 to 14 inches thick.

C8—47 to 67 inches, darker than the horizon above, and redder than dark-brown (7.5YR 4/4), very fine sandy loam; single grain; friable to slightly firm when moist, nonsticky and nonplastic when wet; pH 6.8; clear, wavy lower boundary. 18 to 22 inches thick.

C9—67 to 84 inches, redder than dark-brown (7.5YR 4/4) very fine sandy loam; pockets of brown to pale-brown (10YR 5/3 to 10YR 6/3) very fine sandy loam; single grain; very thin clay films or bridges; friable when moist, nonsticky and nonplastic when wet; pH 5.2; gradual, wavy lower boundary. 15 to 19 inches thick.

C10—84 to 94 inches, redder than dark-brown (7.5YR 4/4) loamy medium sand; a few lenses of light-colored sand; significant amounts of silt and clay; single grain; friable when moist, nonsticky and nonplastic when wet; pH 5.0; clear, wavy lower boundary. 8 to 12 inches thick.

C11—94 to 104 inches, dark-brown (10YR 4/3) medium sand; single grain; very friable when moist, nonsticky and nonplastic when wet; pH 5.0; abrupt, smooth lower boundary. 8 to 12 inches thick.

C12—104 to 154 inches, dark-brown (7.5YR 4/2–3/2) fine sandy loam; single grain; friable when moist, nonsticky and nonplastic when wet; pH 5.2. 40 to 60 inches thick.

Texture of the surface layer ranges from loamy fine sand to silt loam. Texture of the C horizon ranges from sandy loam to sand. The color hue ranges from 10YR to 7.5YR. Tioga soils are subject to occasional overflows of short duration.

Tioga soils are associated most closely with the moderately well drained and somewhat poorly drained Middlebury soils and with the poorly drained Holly soils, both of which are in similar material. Chenango and Tunkhannock soils are on adjacent terraces. Papakating soils are also nearby on the flood plains.

**Tioga loamy fine sand** (Ta).—This soil has a profile similar to the one described for the Tioga series. It is nearly level. Most areas lie close to the Delaware River and are flooded more frequently than the other Tioga soils. The profile of this soil is younger than the one that is typical of the Tioga series, and the horizons contain more organic matter. There is less color difference between the surface soil and subsoil in this soil than in a typical Tioga soil.

Droughtiness and rapid leaching of plant nutrients are the major limitations of this sandy Tioga soil. Occasional flooding early in spring is likely to be a problem. This soil is suited to most crops grown in the area. Crops should be grown in a rotation of medium intensity, and special care is needed to conserve moisture. Irrigation is likely to be needed in most years. (Capability unit IIs–1; woodland suitability group 2)

**Tioga loamy fine sand, high bottom, 0 to 3 percent slopes** (TgA).—This soil has the profile described as typical for the series (fig. 8). It occurs on the higher levels along the Delaware River flood plain, in most places near the outer edge of the valley. It is, therefore, flooded less frequently than the other soils on the flood plain.

Droughtiness and leaching of plant nutrients because of the rapid permeability are the major limitations. This soil is suited, however, to most crops grown in the county. Crops should be grown in a rotation of medium intensity to maintain organic matter and conserve moisture. This soil has moderate limitations for use as building sites because of hazard of flooding. (Capability unit IIs–1; woodland suitability group 2)

**Tioga loamy fine sand, high bottom, 3 to 12 percent slopes** (TgB).—This soil has a profile similar to the one described as typical for the Tioga series. It is higher above the river than the typical Tioga soil and is gently sloping. This soil is also somewhat lighter in color. Most of the areas are in the outside part of the valley, close to the valley wall.

This Tioga soil is droughty, subject to rapid losses of plant nutrients, and subject to erosion unless it is protected. This soil is good for crops, but should be farmed in a rotation of medium intensity to conserve soil and water and to help maintain the organic-matter content. (Capability unit IIs–1; woodland suitability group 2)

**Tioga silt loam** (To).—This soil has a profile similar to the one described as typical for the series, but it is more silty and less sandy. It is nearly level. The soil structure is stronger than in the typical Tioga soil, and there is less color difference between horizons. This Tioga soil has high available moisture capacity, which makes it more productive than the more sandy soils. Crops commonly grown in the county do well. This soil has few limitations and can be farmed intensively. (Capability unit I–1; woodland suitability group 1)


***Figure 8.*—Typical profile of Tioga loamy fine sand, high bottom, 0 to 3 percent slopes, in a grassy field. This soil has nearly uniform texture throughout, but it is darker colored in the uppermost foot because of accumulated organic matter. Numbers on tape indicate depth in feet.**

## Tughill Series

The Tughill series consists of deep, very poorly drained, loamy soils that were formed in glacial till derived from gray sandstone and siltstone. These soils are in depressions, flats, and drainageways of the uplands (fig. 9), particularly in the eastern two-thirds of the county.

These soils are strongly acid. Most areas are channery or stony. The soils have a high water table most of the year, and many areas are ponded during winter and early in spring. Most of the areas are in woods, and a few are in pasture. These soils have severe limitations for crops or for use as building sites because of the high water table and the stones.

A typical Tughill soil in woods has a very dark gray loam surface soil that is about 25 percent coarse fragments. This layer is about 9 inches thick. The subsurface soil is dark-gray, firm gravelly loam that has streaks and splotches of yellowish-brown and gray. It extends to 18 inches. The upper subsoil, to about 25 inches, is dark grayish-brown gravelly loam that has yellowish-brown and olive-gray

mottles. The lower subsoil is dark grayish-brown, firm gravelly loam streaked with gray. This layer extends to a depth of more than 42 inches.

*Figure 9.*—**Typical landscape of Tughill soils in a swampy depression on the plateau.**

Profile of Tughill very stony loam, 0 to 3 percent slopes, east of McConnell Pond in a wooded area:

A1—0 to 9 inches, very dark gray (N 3/0) loam; 25 percent coarse fragments; moderate, medium, granular structure; friable when moist, slightly sticky and nonplastic when wet; pH 5.2, clear, smooth lower boundary. 7 to 10 inches thick.

A2g—9 to 18 inches, dark-gray (N 4/0) gravelly loam; coarse, prominent, yellowish-brown (10YR 5/6) and gray (5Y 5/1) mottles; 20 percent coarse fragments; weak, medium, subangular blocky structure; firm when moist, sticky and plastic when wet; pH 5.4; clear, wavy lower boundary. 6 to 10 inches thick.

B2g—18 to 25 inches, dark grayish-brown (2.5Y 4/2) gravelly loam; common, medium, distinct, yellowish-brown (10YR 5/6) and olive-gray (5Y 5/2) mottles; 20 percent coarse fragments; weak, medium, blocky structure; firm when moist, slightly sticky and slightly plastic when wet; pH 5.6; gradual, wavy lower boundary. 6 to 9 inches thick.

B3g—25 to 42 inches, dark grayish-brown (2.5Y 4/2) gravelly loam; streaked with gray (5Y 5/1); 30 percent coarse fragments; massive breaking to weak, thick, platy and coarse blocky structure; firm when moist, slightly sticky and nonplastic when wet; pH 5.6. 17 to 25 inches thick.

The volume occupied by stones and boulders ranges from 5 to 50 percent. Some areas have thin deposits of alluvial sediments on the surface.

Tughill soils are associated with the somewhat poorly drained Volusia soils and with Peat and Muck. They are also close to areas of the moderately well drained Mardin soils and Wurtsboro soils. They are similar to the Norwich soils but are dark gray and olive rather than brownish.

**Tughill channery silt loam, 0 to 3 percent slopes** (TsA).—This soil has a profile similar to the one described for the series, but it is nonstony and has a more silty surface soil. This soil is in depressions and drainageways where surface water tends to collect. Some areas, where local alluvium has been washed in, have a surface layer thicker than the one described as typical. Included in the mapping of this soil were small areas that are gently sloping.

Wetness is the major limitation of this Tughill soil. The soil is periodically covered with water in winter and spring. This soil is level or nearly level, and there is little or no erosion. It is too wet for most crops but can be cultivated when drained if crops that tolerate wet soil are grown in a rotation of very low intensity. Natural drainageways should be kept open. The soil has severe limitations for use as building sites because of the high water table. (Capability unit IVw-1; woodland suitability group 16)

**Tughill very stony loam, 0 to 3 percent slopes** (TtA).—This soil has the profile described as typical for the Tughill series. Stones and boulders cover 3 to 15 percent of the surface. The soil has not been cultivated, because it is too stony and too wet. It is generally not economical to remove the trees and stones, and the soil can be used best for woods or for wildlife habitats. This soil has severe limitations for use as building sites because of the high water table. (Capability unit VIIs-2; woodland suitability group 16)

## Tunkhannock Series

The Tunkhannock series consists of deep, well-drained, gravelly soils that were formed in stratified, reddish sand and gravel. These soils are on gently sloping glacial outwash terraces in the valleys and on the steeper sides of the valleys where streams formed deltas or kame terraces. They are mainly in the larger valleys of the western part of the county.

Tunkhannock soils are very strongly acid. They have rapid permeability and low moisture-holding capacity. The use of these soils to dispose of liquid wastes is likely to lead to pollution of the ground water.

Most of the gently sloping Tunkhannock soils in the valleys have been cleared and farmed, although many areas are now idle and some are in woods.

A typical Tunkhannock soil in an idle area has a brown gravelly sandy loam plow layer that is 20 percent gravel. This layer is easily tilled and is about 6 inches thick. The upper subsoil is strong-brown gravelly loam that is about 40 percent gravel. This layer is friable, and it extends to a depth of 18 inches. The lower subsoil is light-brown gravelly sandy loam and is about 50 percent gravel. This lower subsoil layer is loose, and it extends to 28 inches. The substratum is brown, loose very gravelly loamy sand that is 75 percent gravel. It extends from 28 inches to 72 inches or more and overlies stratified sand and gravel.

Profile of Tunkhannock gravelly sandy loam, 3 to 12 percent slopes, near Kimbles in an idle field:

Ap—0 to 6 inches, brown (7.5YR 5/4) gravelly sandy loam; 20 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.8; abrupt, smooth lower boundary. 5 to 7 inches thick.

B2—6 to 18 inches, strong-brown (7.5YR 5/6) gravelly loam; 40 percent coarse fragments; weak, fine, granular structure; some bridges of silt and clay; friable when moist, nonsticky and nonplastic when wet; pH 4.6; gradual, wavy lower boundary. 10 to 14 inches thick.

B3—18 to 28 inches, light-brown (7.5YR 6/4) gravelly sandy loam; 50 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 4.6; gradual, wavy lower boundary. 8 to 12 inches thick.

C—28 to 72 inches, brown (7.5YR 5/2) very gravelly loamy sand; 75 percent coarse fragments; single grain; loose when moist, nonsticky and nonplastic when wet; pH 4.4; 40 to 60 inches thick. Underlain by stratified sand and gravel.

Texture in the B horizon ranges from gravelly sandy loam to silt loam. The hue ranges from 7.5YR to 2.5YR.

Tunkhannock soils are associated with the moderately well drained Braceville soils and the somewhat poorly drained Red Hook soils. Nearby are areas of the well drained Cattaraugus soils and the moderately well drained Culvers soils on uplands and of Middlebury soils and Holly soils on the flood plains. Tunkhannock soils are similar to Chenango soils but are more brown or more reddish rather than yellowish brown.

**Tunkhannock gravelly sandy loam, 3 to 12 percent slopes** (TuB).—This soil has the profile described as typical for the Tunkhannock series. Most areas have been cultivated. Some areas are smooth, and others are kamelike; that is, they consist of small hills and depressions.

Droughtiness and rapid leaching of plant nutrients are the major limitations of this soil. Risk of erosion is also a problem because of the slope. This soil is suited to most crops grown in the county, especially early vegetables and truck crops. Crops should be grown in a rotation of medium intensity to maintain soil organic matter. Conservation practices are needed to conserve moisture and soil. Irrigation is needed in some years to obtain good yields. This soil has moderate limitations for use as building sites. (Capability unit IIs–1; woodland suitability group 9)

**Tunkhannock gravelly sandy loam, 12 to 20 percent slopes** (TuC).—This sloping soil has a profile similar to the one described for the series. Most areas have been cultivated, and some are moderately eroded. Included in mapping this soil were some kamic areas, which have irregular slopes and are difficult to farm.

Droughtiness and rapid leaching of plant nutrients are the major limitations of this soil. Risk of erosion is also a problem. This soil is fairly well suited to most crops grown in the area. Crops should be grown in a rotation of low intensity to help maintain organic matter and conserve soil and moisture. This soil has moderate to severe limitations for use as building sites because of the slope. (Capability unit IIIe–1; woodland suitability group 9)

**Tunkhannock gravelly sandy loam, 20 to 30 percent slopes** (TuD).—This soil has a profile similar to the one described for the series. It is moderately steep, and most of it is in woods or pasture. This soil is mainly on escarpments between terraces of different heights.

The major limitations of this soil are the steep slopes and the droughtiness. Erosion is also a problem if the soil is cultivated. If crops are grown, a rotation of very low intensity should be followed and conservation practices are needed. The moderately steep slopes limit the soil severely for use as building sites. (Capability unit IVe–1; woodland suitability group 9)

## Volusia Series

The Volusia series consists of deep, somewhat poorly drained and poorly drained, loamy soils that were formed in glacial till derived from gray, acid sandstone and shale. These soils are nearly level to moderately steep, and in many places their slopes are concave.

Volusia soils are moderately acid to strongly acid. They have moderate to low available moisture capacity. They have slow permeability because of a well-developed fragipan that begins at a depth of 10 to 20 inches. The fragipan slows movement of water and retards penetration of plant roots. Most of the Volusia soils are stony, but in some areas the stones have been removed.

Most of the areas of Volusia soils are in woods, but some areas have been cleared and are farmed.

A typical Volusia soil in woods has a dark grayish-brown channery loam surface soil. This layer is easily tilled; it is about 5 inches thick. In most places there is above this layer of mineral soil a thin, black, tough, fibrous, organic mat and on it a thin layer of leaves and twigs. The upper subsoil is yellowish-brown channery loam that is also easily worked. This layer is only about 2 inches thick. Between 7 and 14 inches is a leached layer that lies just above the fragipan; this layer is light yellowish-brown loam that has medium-sized, distinct, brownish-gray and yellowish-brown mottles.

The fragipan begins at about 14 inches and extends to 42 inches or more. It consists of grayish-brown to pinkish-gray very channery loam that has medium-sized streaks of gray, yellowish brown, and light brownish gray. This layer is firm to very firm and brittle when moist. It is difficult to dig, and breaks into coarse and very coarse prisms that are coated with light brownish-gray silt. The well-developed prisms break into thick plates and coarse blocks. There is similar material below 42 inches, but it has less definite structure.

Profile of a Volusia channery loam east of McConnell Pond in a wooded area:

O1—3 to 2 inches, dark reddish-brown (5YR 2/2) oak leaf litter.

O2—2 inches to 0, black (10YR 2/1) humus, held together in a tough, fibrous mat; pH 5.0; clear, smooth lower boundary. 0 to 3 inches thick.

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) channery loam; 20 percent coarse fragments; moderate, medium, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 5.0; clear, wavy lower boundary. 2 to 6 inches thick.

B2—5 to 7 inches, yellowish-brown (10YR 5/4) channery loam; 20 percent coarse fragments; weak, medium, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 5.0; clear, smooth lower boundary. 0 to 4 inches thick.

A'2g—7 to 14 inches, light yellowish-brown (10YR 6/4) gravelly loam; common, medium, distinct, light brownish-gray (2.5Y 6/2) and yellowish-brown (10YR 5/8) mottles; 25 percent coarse fragments; weak, medium, granular structure; friable when moist, nonsticky and nonplastic when wet; pH 5.2; clear, smooth lower boundary. 6 to 8 inches thick.

B'x1—14 to 36 inches, grayish-brown (2.5Y 5/2) gravelly loam; common, medium, distinct, yellowish-brown (10YR 5/8) and gray (10YR 5/1) mottles; 25 percent coarse fragments in the upper part, increasing to 50 percent in the lower part; coarse, prismatic, breaking to weak, thick, platy and coarse blocky structure; light brownish-gray (2.5Y 6/2) silt and clay coatings; very firm when moist, sticky and slightly plastic when wet; pH 5.4; diffuse, smooth lower boundary. 20 to 30 inches thick.

B'x2g—36 to 42 inches, pinkish-gray (5YR 6/2) very gravelly loam; 75 percent coarse fragments; massive, breaking to weak, medium, blocky structure; light brownish-

gray (2.5Y 6/2) silt and clay coatings; firm when moist, slightly sticky and nonplastic when wet; pH 5.6. 6 to 24 inches thick.

Depth to the fragipan ranges from 10 to 20 inches. The volume occupied by stones and boulders ranges from 10 to 50 percent. Boulder trains are common on Volusia soils.

Volusia soils are associated most closely with the moderately well drained Wurtsboro and Mardin soils and with the very poorly drained Tughill soils. Also nearby are areas of the moderately deep, well-drained Manlius soils and the deep, well-drained Swartswood soils. The Volusia soils associated with Manlius soils in the eastern part of the county are more silty throughout the profile than are the Volusia soils associated with Swartswood soils in the central part of the county. Volusia soils are similar to Morris soils, but are yellowish brown and olive rather than brown and reddish brown.

**Volusia channery loam, 0 to 3 percent slopes** (VcA).—This soil has a profile similar to the one described for the series, but it is nonstony and it has been cleared and cultivated. The cultivation has mixed the organic layers with the upper mineral soil to produce a thicker, darker layer than the one described in the typical profile. This soil is level or nearly level and is on concave slopes where surface water tends to accumulate. It has a seasonal high water table because of the fragipan.

Wetness is the major limitation. This soil dries out late in spring and is not suited to plants that freeze out or drown easily. If crops are grown, the rotation should be one of low intensity. Drainage is needed to remove the surface and subsurface water. This soil has severe limitations for use as building sites because of the seasonal high water table. (Capability unit IIIw–1; woodland suitability group 13)

**Volusia channery loam, 3 to 8 percent slopes, moderately eroded** (VcB2).—This soil has a profile similar to the one described for the series. It is gently sloping and has lost about one-fourth of its surface layer through erosion. The plow layer is somewhat thinner and lighter colored than that of an uneroded Volusia soil. Most of this soil has been cultivated, but there are some small areas of woods and pasture. In these areas there has been little or no erosion.

The major limitations of this soil are wetness and the seasonal high water table caused by the fragipan. Crops may be grown if the rotation is one of low intensity, and if drainage practices are installed to remove surface and subsurface water. The crops should be tolerant of a wet soil. (Capability unit IIIw–1; woodland suitability group 13)

**Volusia very stony silt loam, 0 to 8 percent slopes** (VuB).—This soil has a profile more silty than the typical one described for the Volusia series. It has not been cultivated. A few areas of a gently sloping channery loam were included in the areas mapped.

Stones and poor surface drainage are the major limitations of this Volusia soil. There is very little erosion. This soil is suited to trees and wildlife habitats and can be used for pasture, but generally it is not worthwhile to remove the trees and stones and prepare the soil for pasture. This soil has moderate to severe limitations for use as building sites. (Capability unit VIIs–1; woodland suitability group 13)

**Volusia very stony silt loam, 8 to 25 percent slopes** (VuD).—This soil has a profile more silty than the typical one described for the Volusia series. It has not been cultivated. A few areas of a strongly sloping channery loam soil were included in the areas mapped.

Stones, wetness, and slope are the major limitations of this Volusia soil. There is not much erosion in the woods, even though the slopes are moderately steep. The soil is suited to extensive permanent pasture, but removal of the trees and stones generally is not economical. The moderately steep slopes and the seasonal high water table are severe limitations for use of this soil as building sites. (Capability unit VIIs–1; woodland suitability group 13)

## Wurtsboro Series

The Wurtsboro series consists of deep, moderately well drained, sandy soils that were formed in glacial till derived from acid, gray sandstone and siltstone. These soils are gently sloping to moderately steep and are on plane or slightly concave slopes of the uplands in the eastern two-thirds of the county.

The Wurtsboro soils have moderate available moisture capacity and slow permeability through the profile. These soils have a fragipan that begins about 20 inches below the surface. It is a dense, brittle layer that impedes the movement of water and the growth of roots. The soils are very strongly acid.

Nearly all the Wurtsboro soils in Pike County are so stony that they have severe limitations for crops and moderate to severe limitations for use as building sites.

A typical Wurtsboro soil in woods has a thin, friable, dark grayish-brown loam surface soil. Above the mineral soil is a thin, black layer of leaf mold and on it a thin layer of leaves and twigs. The second layer of mineral soil is strong-brown loam that has weak, granular structure. This layer is friable and easily tilled, and it extends to a depth of 5 inches. The subsoil to 20 inches is yellowish-brown gravelly loam or sandy loam that has weak, medium, rounded blocky structure. The upper part of the fragipan consists of yellowish-brown gravelly sandy loam that has many, prominent, gray and strong-brown mottles. If dug, this layer is firm to very firm. It breaks into moderately well defined, coarse prisms, which in turn break into thick plates. It extends to 36 inches. The lower part of the fragipan, to 48 inches or deeper, is grayish-brown and brown gravelly loam and gravelly sandy loam that has gray and strong-brown mottles. This layer breaks into moderately well developed, very coarse prisms that are coated with gray silt. These prisims break into thick plates. The soil is very firm or brittle and difficult to dig.

Profile of Wurtsboro very stony sandy loam, 0 to 8 percent slopes, south of Standing Stone in a wooded area; sampled for characterization, Profile S64–Pa–52–2(1–9), and described in detail:

O1—3 inches to 1 inch, very dark gray (10YR 3/1) leaf litter, mostly oak leaves.

O2—1 inch to 0, black (10YR 2/1) leaf mold, roots, and fungus mycelia held together in a tough, fibrous mat.

A2—0 to 1 inch, dark grayish-brown (10YR 4/2) loam; 10 percent gravel; weak, fine, granular structure, friable when moist, nonsticky and nonplastic when wet; pH 3.3; abrupt, wavy lower boundary. ½ inch to 1½ inches thick.

B2ir—1 inch to 5 inches, strong-brown (7.5YR 5/6) loam; 15 percent coarse fragments; weak, fine, granular structure; some organic staining; friable when moist, nonsticky and nonplastic when wet; pH 4.1; gradual, wavy lower boundary. 3 to 6 inches thick.

B21—5 to 11 inches, yellowish-brown (10YR 5/6) gravelly loam; 20 percent coarse fragments; weak, medium,

subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; pH 4.5; gradual, wavy lower boundary. 4 to 8 inches thick.

B22—11 to 20 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; 20 percent coarse fragments; weak, medium, subangular blocky and weak, medium platy structure; friable when moist, nonsticky and nonplastic when wet; pH 4.3; abrupt, wavy lower boundary. 7 to 12 inches thick.

Bx1—20 to 28 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; many, medium, prominent, gray (10YR 6/1) and strong-brown (7.5YR 5/6) mottles on prism faces and prism linings; 20 percent coarse fragments; moderate, very coarse, prismatic breaking to weak, thick, platy structure; few clay films in pores; firm when moist, nonsticky and nonplastic when wet; pH 4.5; gradual, wavy lower boundary. 3 to 10 inches thick.

Bx2—28 to 36 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; many, coarse, prominent, gray (10YR 6/1) and strong-brown (7.5YR 5/6) mottles on prism faces and prism linings; 20 percent coarse fragments; moderate, very coarse, prismatic breaking to weak, thick, platy structure; few clay films in pores; very firm when moist, nonsticky and nonplastic when wet; pH 4.4; diffuse, wavy lower boundary. 5 to 12 inches thick.

Bx3—36 to 48 inches, grayish-brown (10YR 5/2) gravelly loam; few, medium, distinct, gray (10YR 6/1) and strong-brown (7.5YR 5/6) mottles on prism faces and prism linings; 25 percent coarse fragments; moderate, very coarse, prismatic breaking to moderate, thick, platy structure; few clay films in pores; very firm when moist, slightly sticky and slightly plastic when wet; pH 4.2; diffuse, wavy lower boundary. 8 to 16 inches thick.

Bx4—48 to 56 inches +, brown (10YR 5/3) gravelly sandy loam; gray (10YR 6/1) prism faces and strong-brown (7.5YR 5/6) linings; 20 percent coarse fragments; moderate, very coarse, prismatic breaking to moderate, very thick, platy structure; few brown concretions and coatings; very firm when moist, nonsticky and nonplastic when wet; pH 4.8; 10 to 15 inches thick. Underlain by similar material.

Thickness of the solum ranges from 3½ to 6 feet. Depth to hard rock ranges from 4 feet to 20 feet or more. The fragipan normally begins at a depth between 15 and 24 inches. Distinct or prominent mottling begins between 12 and 30 inches below the surface. The amount of coarse fragments in the solum ranges from 10 to 40 percent. Sandstone, conglomerate, and quartzite stones and boulders are common on the surface and in the solum. Texture of the solum ranges from loam to sandy loam.

Color of the A horizon has a hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 1 to 4. Color of the B horizon has mostly a hue of 10YR, but ranges to a hue of 7.5YR, value of 4 or 5, and chroma ranging from 1 to 4. There are a few thin patches of clay films lining the pores and some clay bridges, but evidence of any appreciable amount of clay movement is lacking. Base saturation is less than 35 percent. Reaction is extremely acid to very strongly acid. A thin spodic sequence of an A2 and a Bir horizon is present in the upper solum in most places where the soil has not been disturbed.

The Wurtsboro soils are associated with the deep, well-drained Swartswood soils, the moderately deep or deep, well-drained Dekalb soils, the somewhat poorly drained and poorly drained Volusia soils, and the very poorly drained Tughill soils. They are similar to the Culvers soils, but are yellowish brown to olive brown rather than reddish brown or brown. They are similar to the Mardin soils but have coarser texture throughout the profile.

**Wurtsboro very stony sandy loam, 0 to 8 percent slopes** (WuB).—This soil has the profile that is described as typical of the Wurtsboro series. Stones and boulders cover 3 to 15 percent of the surface. Most of the areas are wooded. The seasonal high water table and the stones are the major limitations. This soil is nearly level or gently sloping and is subject to little or no erosion. Stones make plowing impractical, and removal of trees and stones is generally not economical. The soil is suited to permanent pasture, but intensive management is generally not feasible. It is moderately limited for use as building sites because of the high water table. (Capability unit VIs–1; woodland suitability group 9)

**Wurtsboro very stony sandy loam, 8 to 25 percent slopes** (WuC).—This soil has a profile similar to the one described as typical for the Wurtsboro series. It is moderately steep. Stones and boulders cover 3 to 15 percent of the surface. This soil has not been cultivated, and most of it is in woods. There is not much erosion. Slope, stones, and a seasonal high water table are its major limitations. The stones make cultivation impractical, and the soil can be more easily managed as permanent pasture. The strong slope is a severe limitation for use of this soil as building sites. (Capability unit VIs–1; woodland suitability group 9)

# *Formation and Classification of Soils*

The first part of this section tells how the soils of Pike County were formed and describes the factors that influence soil formation. The second part deals with the classification of soils.

## Formation of Soils

Soils are complex mixtures of weathered rock, primary minerals, secondary minerals, organic matter, water, and air. The components are present in varying quantities. Soil is formed through the action of climate, plants, and animals on chemically and physically weathering geologic materials over long periods of time.

### *Factors of soil formation*

The characteristics of all soils depend on the nature of the parent material, the climate of the area, the relief or lay of the land, the plant and animal life, and the length of time the materials have been exposed.

In a small area such as Pike County, in which vegetation and climate have little variation, the nature of the parent material affects strongly the local variations in texture and mineral content of the soils. Climate influences the nature of the weathering and soil-forming processes. Relief affects drainage, aeration, runoff, erosion, and exposure to sun and wind. Plant and animal life influence soils by both physical and chemical removals and additions. Time is required for all of the other soil-forming factors to have their effects. The soil is constantly changing, and it is only after long periods of time that most features in the soil become apparent.

*Parent materials* of the soils of Pike County were mostly glacial till and in outwash sand and gravel. These materials were derived mainly from local red and gray sandstone, siltstone, and shale.

The soils on the uplands, such as the Swartswood, Mardin, Volusia, and Norwich soils, were developed in the deep glacial till that covers most of the county. Where the slopes are steepest, little glacial till was deposited, or it was eroded away after the glaciers retreated. In these areas the moderately deep Oquaga and Dekalb soils are

present. The steep slopes of the Delaware River bluffs, where shale is exposed, have on them Manlius soils. Along the foot of the bluffs, there are accumulations of shale chips in which were formed the Rushtown soils.

Soils such as Chenango, Tuckhannock, Braceville, and Red Hook were formed in outwash sand and gravel that were deposited in the larger stream valleys and as scattered kames or terraces in the uplands.

The alluvial deposits along the streams consist of stratified silt, sand, and gravel, in which are some of the youngest soils of the county, such as the Tioga, Middlebury, Holly, and Papakating soils.

The uplands have many closed depressions and blocked valleys in which there are small lakes or shallow ponds. In some of these places sphagnum bogs developed, and in others woody vegetation gradually encroached on the lakes. In this wet environment plants grew, died, and fell into the water, where they were preserved in part. Peat and Muck soils were formed in these accumulations of organic materials.

*The climate* of Pike County is the humid, temperate, continental type of the Middle Atlantic States. Some features of soils in the county indicate that this kind of climate influenced development of the soils. Most of the soils are very acid and have been leached of bases. The effect of climate on development of the soils has been fairly uniform throughout the county, but microclimates caused by differences in relief have influenced individual soils.

*Relief* in Pike County is controlled to a large extent by the nature of the geologic formations and by the presence of the Delaware River along the eastern boundary and the Lackawaxen River near the northern boundary.

Before the advance of the Wisconsin glaciers, the streams had dissected the uplands and formed the valleys to produce a hilly landscape. The advancing ice tended to plane off the hills and fill in many of the stream valleys. The major streams then cut into these unconsolidated deposits, and the uplands now form a gently sloping to moderately steep plateau. Slopes in few places exceed 25 percent, except in the eastern part of the county where the major streams have cut 200 to 400 feet into the plateau.

The bedrock is about the same over most of the county and consists of beds of sandstone and shale that dip gently to the northwest and have an occasional mild anticlinal arch. The bedrock had only mild influence on the topography, which was formed by erosion and then changed by planing down the hills and filling the valleys. The retreat of the Wisconsin ice left a rather subdued, rolling topography. There is glacial till on most of the uplands and outwash in the major valleys. A few kames and terraces are scattered over the landscape.

*Plants and animals* affect formation of soils. Pike County was covered by hardwood forests of the oak-hickory type, smaller forests of the sugar maple-beech-yellow birch type, and some stands of hemlock and white pine on the cooler, wetter sites at high elevations. The soils of the county are typical of soils developed under forest cover. Where undisturbed, they have leaf litter over a 1- to 3-inch, black O2 horizon; next, a 1- to 2-inch, dark A1 horizon; and under the organic horizon, a 5- to 9-inch, light-colored A2 horizon, such as the one described in the profile that is a typical one for the Dekalb series. As the forests were cleared and farmed, the organic layers were mixed into the plow layer or were burned. In many places the soil was left exposed to wind and rain, which produced accelerated erosion. Man, through such practices as plowing, cultivation, artificial drainage, manuring, and maintenance of perennial grass and legumes, has had and will continue to have major effects on the soils.

*Time* is needed to produce soils. The last glacial advance and retreat in the Pike County uplands was of Wisconsin age some 10,000 to 14,000 years ago. The soils, therefore, are not so old nor so well developed as most of those in the southeastern counties of Pennsylvania, which have not been glaciated.

Soils in alluvial materials, such as those of the Tioga and Middlebury series, are young or recent soils because their parent materials have been in place for a shorter time than the parent materials of other soils. The soils in alluvial materials generally have less distinct horizons than many of the older soils on uplands. In the uplands and on the terraces, Dekalb, Oquaga, and Chenango soils have horizons that show that some changes have taken place, but these changes are not the results of advanced weathering and soil formation. Weathering and profile development of those soils were slowed by the effects of topography and parent materials. Swartswood, Volusia, and Tughill soils are examples of soils in the county that have developed profiles having fairly distinct horizons.

### Processes of soil formation

As weathering proceeds and plants grow on a young soil, several processes take place that tend to form the layers that are called horizons.

*Gains* occur as leaves and organic remains fall on the surface. The organic remains are easily seen in undisturbed areas of soils, such as Dekalb or Tughill, which were formed under trees. Gains of organic matter and minerals, including some plant nutrients, may also be brought about by animals, floods, wind, or gravity.

*Losses* from the soil occur when minerals are decomposed and some of the products of weathering are leached from the soil by percolating water. Losses also occur when nutrients are removed in harvesting crops, forage, or trees. Fine particles of soil are removed by erosion, and gases escape when organic matter decays.

*Transfers* of material from one part of the soil to the other are common in most soils. Organic matter is moved from the upper part of the profile to the lower part in suspension or in solution. Calcium is leached from the surface layer, and some is held for a while by the clay of the subsoil. Silt and clay coatings in the B horizon of Wurtsboro and Manlius soils indicate the transfer of silt and clay from horizons higher in the profile. Bases and other nutrients are moved when they are absorbed by plant roots and rise in the stems to be stored in leaves and twigs. When the plants die and decay, the nutrients are returned to the soil.

*Transformations* in a soil occur as chemical weathering takes place. For example, iron, aluminum, calcium, and other elements are released from the primary and secondary minerals in the soil and changed into other compounds. In the well-drained Manlius soils, the gray and black colors of the parent materials gradually are replaced by brown and yellow colors of the more weathered and oxidized iron compounds. The brown and yellow colors indicate the release of iron or the oxidation of ferrous oxides

to ferric oxides in the presence of an adequate supply of oxygen.

As a result of the interactions of these processes, layers of soil are formed that have different characteristics and that lie nearly parallel to the surface. A vertical exposure of soil shows these layers, which are called horizons. The horizons of a soil make up its profile.

### *The soil profile*

The sequence of horizons in a well-developed soil profile under forest vegetation is described as follows:

The O1 and O2 horizons, composed mainly of remains of plants, are generally the first to form on the accumulated parent materials. The O1 horizon is the layer of loose leaves and twigs on the surface. The O2 horizon is one of partially decomposed organic matter. Examples of the organic horizons are given in the technical descriptions of the Cattaraugus and the Dekalb series.

The A horizon, or surface layer of mineral soil, is under the O2 horizon. Its formation parallels that of the O2 horizon. The A horizon is commonly subdivided into two layers, the A1 and the A2 horizon. The A1 horizon consists of mixed organic and mineral soil material and is dark colored. The A2 horizon, under the A1 horizon, becomes evident when weathering and leaching remove soluble substances to form a lighter colored layer. This leached horizon is called an eluviated horizon; one is present in the Dekalb soils. When A1 and A2 horizons are mixed in plowing, and crop residues and manure are incorporated into the surface layer, the horizon is designated Ap. Examples of Ap horizons are the ones described in the technical descriptions of the Tioga and the Tunkhannock soils.

The B horizon, a zone of accumulation or other change, is beneath the A horizon. Its formation follows or takes place along with that of the A horizon. It is often called the illuviated horizon, which is the horizon that has retained some of the substances that moved out of the A horizon, such as clay, iron and aluminum compounds, and organic colloids. It is also a horizon that contains many secondary minerals. These are predominantly silicate clay, and they were formed by the alteration of primary minerals. The B horizon is formed as a result of both illuviation and transformation. In most places the B horizon contains more clay and less organic matter than the A horizon.

The normal B horizon has three main subdivisions—B1, B2, and B3. The B1 horizon has weakly developed features of the main B horizon. The B2 horizon in most well-developed soils is the layer that has the greatest amount of accumulated clay and the brightest colors. The analytical data and the technical description of the Wurtsboro profile and the Chenango profile show a weakly developed textural B horizon. The B3 horizon has some of the properties of the B horizon and some properties of the substratum. It generally contains less accumulated clay and fewer altered minerals than the B2 horizon.

The A and B horizons make up the solum, which is the zone in which most of the organic and mineral matter has been added, removed, transferred, or translocated through soil-forming processes. Below the solum is the C horizon, which is the partially weathered parent material. It is the deepest of the three major horizons. It is commonly coarser textured and lighter colored than the B horizon. It may contain some weathered materials that leached out of either the A or the B horizon. It is composed mainly of partly weathered minerals and rock fragments. In Pike County the C horizon in most soils is glacial till.

## Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First, through classification, and then through use of soil maps, we can apply our knowledge to specific fields and other tracts of land.

Thus, in classification, soils are placed in narrow classes that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. They are placed in broad classes of higher categories to facilitate study and comparison in large areas, such as counties, regions, and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and revised later (*12*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study (*10*, *17*). Therefore, readers interested in developments of the system should search the latest literature available.

Under the current system of classification, six categories, or levels in the system, are recognized. Beginning with the broadest and most inclusive, these are the order, the suborder, the great group, the subgroup, the family, and the series. Table 10 gives the family, subgroup, and order for each soil series in the county under the current classification, as well as the great soil groups of the 1938 classification.

# *Laboratory Data*

The physical and chemical properties of soil samples from a profile of each of 5 soil series in the county are shown in tables 11 and 12. The series sampled for analysis are the Chenango, Manlius, Swartswood, Tioga, and Wurtsboro. Typical profiles were located in areas representative of the series with respect to internal characteristics, slope, erosion, and dominant land use. Samples were collected from each horizon that could be recognized in a pit dug through the solum and into the substratum.

## Methods of Analysis

Laboratory analyses were made at the Soil Characterization Laboratory of the Pennsylvania State University by R. P. Matelski and R. L. Cunningham and staff. Clay mineral determinations and interpretations were made by L. J. Johnson. The laboratory methods used at the Pennsylvania Soil Characterization Laboratory were as follows:

One gallon or more of material was collected from each horizon. The amount of coarse fragments was determined by sieving the relatively unaltered rock fragments that

TABLE 10.—*Soil series classified according to the present system of classification and the 1938 system with its later revisions*[1]

| Series | Current classification | | | 1938 classification |
|---|---|---|---|---|
| | Family | Subgroup | Order | Great soil group |
| Atherton | Fine-loamy, mixed, nonacid, mesic | Aeric Haplaquepts | Inceptisols | Humic Gley soils. |
| Braceville | Coarse-loamy, mixed, mesic | Typic Fragiochrepts | Inceptisols | Sols Bruns Acides. |
| Cattaraugus | Coarse-loamy, mixed, mesic | Typic Fragiochrepts | Inceptisols | Sols Bruns Acides. |
| Chenango | Loamy-skeletal, mixed, mesic | Typic Dystrochrepts | Inceptisols | Sols Bruns Acides. |
| Culvers | Coarse-loamy, mixed, mesic | Typic Fragiochrepts | Inceptisols | Sols Bruns Acides. |
| Dekalb | Loamy-skeletal, mixed, mesic | Typic Dystrochrepts | Inceptisols | Sols Bruns Acides. |
| Holly | Fine-silty, mixed, nonacid, mesic | Fluventic Haplaquepts | Inceptisols | Low-Humic Gley soils. |
| Manlius | Loamy-skeletal, mixed, mesic | Typic Dystrochrepts | Inceptisols | Sols Bruns Acides. |
| Mardin | Fine-loamy, mixed, mesic | Typic Fragiochrepts | Inceptisols | Sols Bruns Acides. |
| Middlebury | Coarse-loamy, mixed, mesic | Aquic Fluventic Eutrochrepts | Inceptisols | Alluvial soils. |
| Morris | Coarse-loamy, mixed, mesic | Aeric Fragiaquepts | Inceptisols | Sols Bruns Acides. |
| Norwich | Fine-loamy, mixed, mesic | Typic Fragiaquepts | Inceptisols | Humic Gley soils. |
| Oquaga | Loamy-skeletal, mixed, mesic | Typic Dystrochrepts | Inceptisols | Sols Bruns Acides. |
| Papakating | Fine-silty, mixed, nonacid, mesic | Fluventic Haplaquepts | Inceptisols | Humic Gley soils. |
| Red Hook | Coarse-loamy, mixed, mesic | Aeric Haplaquepts | Inceptisols | Sols Bruns Acides. |
| Rushtown | Fragmental, mixed, mesic | Typic Udorthents | Entisols | Sols Bruns Acides. |
| Swartswood | Coarse-loamy, mixed, mesic | Typic Fragiochrepts | Inceptisols | Sols Bruns Acides. |
| Tioga | Coarse-loamy, mixed, mesic | Dystric Fluventic Eutrochrepts | Inceptisols | Alluvial soils. |
| Tughill | Coarse-loamy, mixed, acid, frigid | Histic Humaquepts | Inceptisols | Humic Gley soils. |
| Tunkhannock | Loamy-skeletal, mixed, mesic | Typic Dystrochrepts | Inceptisols | Sols Bruns Acides. |
| Volusia | Fine-loamy, mixed, mesic | Aeric Fragiaquepts | Inceptisols | Sols Bruns Acides. |
| Wurtsboro | Coarse-loamy, mixed, mesic | Typic Fragiochrepts | Inceptisols | Sols Bruns Acides. |

[1] Placement of some soil series in the present system of classification may change as more precise information becomes available.

would not pass through a 2-millimeter sieve, and was calculated as percent by weight of the bulk sample. The clods of earthy material were crushed and were not considered as coarse fragments. Care was taken not to break the relatively unaltered rock into fragments small enough to pass the 2-millimeter sieve. All analyses, except those for coarse fragments, bulk density, and moisture retained at 1/3 atmosphere of tension, were made on the fraction of the sample that passed the 2-millimeter sieve.

The particle-size distribution of the material passing the 2-millimeter sieve was determined by the pipette method (*5*). The soil was dispersed using sodium hexametaphosphate and mechanical shaking (*6*).

Bulk density was determined on 1- by 2-inch cylindrical core samples taken with a Salinity Laboratory modified Uhland core sampler (*13, 15*). Samples were taken in triplicate for the bulk density determinations, and the values obtained were averaged and then reported.

Moisture retained at a tension of 1/3 atmosphere was determined by testing core samples on a porous plate (*8*). Moisture retained at a tension of 15 atmospheres was determined by testing fragmented samples in the pressure membrane apparatus (*8*).

The reaction was measured on fresh soil samples in the field by a Beckman zeromatic pH meter using a soil-water ratio of 1:1.

The extractable cations were determined in an ammonium acetate extract at pH 7; calcium (Ca) and magnesium (Mg) by titration; sodium (Na) and potassium (K) by flame photometry. A barium chloride-triethanolamine extract, pH 8.2, was titrated with 0.005 N HCl to determine exchangeable acidity. The sum of the total bases (Ca, Mg, Na, and K) and the exchangeable acidity equals the cation-exchange capacity.

A dichromate-sulfuric acid digestion was titrated with ferrous ammonium sulfate to determine organic carbon (*7*). Organic carbon multiplied by 1.724 approximates the percentage of organic matter.

Nitrogen was determined by the Kjeldahl method, modified by trapping ammonia in a boric acid solution and titrating with sulfuric acid (*7*).

A sodium dithionite extract was titrated with dichromate to determine the amount of free iron oxides (*4*).

## Procedure for Clay Mineralogy

Air-dry and sieved soil samples were treated with hydrogen peroxide to destroy organic matter. Further treatment with oxalic acid-potassium oxalate and with magnesium ribbon reduced the iron oxide coatings (*3*). The clay was separated with a centrifuge, and one portion was saturated with potassium and one portion with magnesium. Clay samples were pipetted onto glass slides and allowed to air dry. Both slides were used to obtain X-ray diffraction traces. The magnesium-saturated slide was then solvated with ethylene glycol; the potassium-saturated slide was heated to 300° C. and to 500° C., successively. The X-ray diffraction patterns were obtained after each of these treatments.

The traces were interpreted and presented as percentage of each kind of clay to the nearest 5 percent. This interpretation is based on peak height and some relationships of known clay mixtures.

## Summary of Data

Physical properties are most important in assessing the engineering or structural value of soils; also, physical properties influence the tilth and the moisture regime, both of which are important in agricultural uses.

The size of soil particles and the size distribution influence internal friction and cohesion of the soil material. Stability and most structural properties of the soil depend largely on the combined effects of internal friction and cohesion. Capillarity, permeability, elasticity, and compressibility also depend largely on particle size and distribution throughout the soil mass.

The proportions of the different size particles determine the textural class, which is one of the characteristics used in soil classification.

Chemical properties of soils are most important in assessing their natural fertility and appraising their agricultural value. Chemical properties also govern the rate of corrosion and weathering of buried engineering structures.

*Chenango soils.*—Studies of the profiles of Chenango soils show that the amount of coarse fragments increases with increasing depth. It ranges from 15 percent in the surface layer to 80 percent or more near a 20-inch depth. The large amount of coarse fragments reduces the available moisture capacity. In a 60-inch section of soil, the available moisture capacity ranges from 3.5 to 4.5 inches of water.

In wooded areas the organic matter in these soils is concentrated in the upper horizons. The amount decreases abruptly in the A2 and B2 horizons and then further decreases rapidly. The Chenango soils are very strongly acid or extremely acid. They have a low clay content and, therefore, a low cation-exchange capacity below the organic layers. The low exchange capacity indicates that the soils have little ability to hold nutrents for plant use. Consequently, these soils must be limed and fertilized frequently.

The Chenango soils contain clays that are dominated by vermiculite and interstratified clay minerals, and they have some illite. There are significant amounts of kaolin. The koalin is associated with a relatively low amount of illite and with high amounts of vermiculite and of interstratified minerals. The distribution suggests that the kaolin in the surface soil is a result of stratification or weathering.

These soils are generally of Wisconsin age and therefore have not been weathered very much. Most of the Chenango soils have a low amount of kaolin. The kaolin in this profile appears to be inherited.

*Manlius very rocky silt loam.*—This Manlius soil was developed in woods and has not been cultivated. Organic matter is most abundant in the two upper horizons. The amount decreases abruptly in the first two horizons of mineral soil and then decreases steadily with depth. The reaction is very strongly acid to extremely acid but is slightly less acid at increasing depth. This soil has higher cation-exchange capacity than the others that were sampled, because of the greater content of clay, fine silt, and organic matter in the upper horizons.

With reference to clay minerals, the Manlius soils are dominated by illite and vermiculite and contain lesser amounts of chlorite and of interstratified clay minerals. A small amount of montmorillonite was detected in the A1 horizon of one sample. (Data for that sample are not given in this survey.) Illite and chlorite increase with depth, whereas vermiculite and interstratified clay minerals decrease with depth. This relationship indicates that the illite and chlorite were inherited from the parent material, but the vermiculite and the interstratified minerals were formed by weathering. The dominance of clay minerals having the 2:1 layer lattice indicates a relatively young soil that has not weathered very much.

*Swartswood very stony sandy loam.*—The Swartswood profile does not have a developed textural B horizon. There is little or no increase in clay content with depth. The nearly uniform clay content indicates that little clay has been moved within the soil. In other Swartswood profiles the amount of clay decreases with depth. The content of coarse fragments in the profile reported in table 11 is greatest at a depth of 12 to 18 inches and ranges from 18 percent to 62 percent in the different horizons. The content of coarse fragments in three other profiles ranged within limits more narrow than these.

Available moisture capacity is medium to low because of the coarse fragments, the coarse texture of the material finer than 2 millimeters, and the presence of a fragipan. Bulk density of the two fragipan horizons (Bx1 and Bx2) is high, about 1.7.

The content of organic matter decreases rapidly with depth. All the Swartswood soils are extremely acid to very strongly acid. The surface layers are more acid than those deeper in the profile. The cation-exchange capacity is very low below the organic layers, reflecting the coarse texture and the low clay content. The Swartswood soils, therefore, have poor ability to hold nutrients for plant growth.

The analysis for clay minerals shows that the Swartswood soil is dominated by illite and contains secondary amounts of vermiculite and lesser amounts of chlorite and of interstratified clay minerals. Illite and chlorite increase with depth, and the increase suggests that these minerals were inherited from the parent material. The decreasing amount of vermiculite and interstratified minerals with depth indicates that these minerals are mainly products of weathering. The amount of montmorillonite is relatively high. Montmorillonite is a transitional mineral, and the amount depends on the recycling of bases to the surface in organic matter and the release of other minerals as the primary minerals are weathered.

*Tioga soils.*—The clay content of the Tioga soil that was analyzed is low. It ranges from about 1 percent to 7 percent, and there is no indication that clay content of the subsoil has been increased by illuviation. There are no coarse fragments larger than 2 millimeters.

The cultivated Ap horizon contains about 0.47 percent organic carbon. Below that horizon the organic-matter content is less and is fairly constant. The reaction is neutral to strongly acid and is generally more acid at increasing depth. The cation-exchange capacity is low and is fairly constant in the different horizons. The low, nearly uniform cation-exchange capacity reflects the low clay content.

The clay of the Tioga soils is dominated by illite but contains also smaller amounts of chlorite and vermiculite. There is just a trace of interstratified clay minerals throughout the profile. The soils have relatively uniform distribution of clay minerals. Such distribution confirms the belief, already indicated in the field descriptions, that the sediments were similar when deposited. The nearly uniform amount of illite and the secondary amount of chlorite indicate relatively fresh material that has been in place for a short time and has not weathered appreciably. The small amount of interstratified clay minerals suggests little weathering of the illite. Probably, most of

TABLE 11.—*Mechanical analyses and*

[Laboratory analyses made at the Soil Characterization Laboratory of the Pennsylvania State University.

| Soil name and sample number | Horizon | Depth | Particle-size distribution | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Very coarse sand (2.0 to 1.0 mm.) | Coarse sand (1.0 to 0.5 mm.) | Medium sand (0.5 to 0.25 mm.) | Fine sand (0.25 to 0.10 mm.) | Very fine sand (0.10 to 0.05 mm.) | Coarse silt (0.05 to 0.005 mm.) |
| | | *Inches* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| Chenango: | | | | | | | | |
| S64Pa52-3-1 | A2 | 0–2 | 2. 3 | 4. 2 | 15. 1 | 18. 2 | 10. 0 | 32. 2 |
| S64Pa52-3-2 | B2ir | 2–4 | 4. 8 | 6. 7 | 16. 0 | 16. 0 | 10. 0 | 29. 8 |
| S64Pa52-3-3 | B21 | 4–9 | 9. 0 | 13. 5 | 15. 7 | 12. 9 | 7. 1 | 27. 6 |
| S64Pa52-3-4 | B22 | 9–16 | 12. 9 | 17. 7 | 19. 5 | 14. 4 | 6. 0 | 19. 8 |
| S64Pa52-3-5 | IIB23 | 16–26 | 25. 9 | 27. 7 | 29. 6 | 6. 8 | 2. 3 | 4. 7 |
| S64Pa52-3-6 | IIC | 26–50 | 22. 5 | 42. 4 | 24. 7 | 5. 4 | 1. 3 | 2. 1 |
| Manlius: | | | | | | | | |
| S64Pa52-6-3 | A1 | 0–3 | 1. 8 | 1. 6 | 3. 5 | 7. 4 | 11. 9 | 52. 1 |
| S64Pa52-6-4 | A2 | 3–8 | 6. 9 | 3. 5 | 2. 8 | 4. 4 | 7. 5 | 52. 9 |
| S64Pa52-6-5 | B2 | 8–19 | 6. 2 | 4. 9 | 3. 8 | 5. 2 | 8. 2 | 48. 7 |
| S64Pa52-6-6 | B3 | 19–25 | 7. 9 | 8. 0 | 7. 9 | 9. 5 | 9. 9 | 38. 5 |
| S64Pa52-6-7 | C | 25–30 | 16. 8 | 12. 5 | 9. 5 | 11. 0 | 10. 5 | 29. 7 |
| Swartswood: | | | | | | | | |
| S64Pa52-4-1 | A2 | 0–2 | 2. 5 | 2. 3 | 10. 6 | 23. 4 | 19. 6 | 34. 9 |
| S64Pa52-4-2 | B2ir | 2–7 | 2. 0 | 3. 3 | 10. 9 | 21. 5 | 18. 6 | 34. 7 |
| S64Pa52-4-3 | B21 | 7–12 | 2. 3 | 8. 6 | 11. 1 | 20. 1 | 17. 6 | 30. 6 |
| S64Pa52-4-4 | B22 | 12–18 | 6. 4 | 4. 9 | 10. 3 | 20. 0 | 16. 4 | 29. 9 |
| S64Pa52-4-5 | B23 | 18–21 | 7. 6 | 6. 5 | 11. 0 | 19. 7 | 16. 5 | 29. 3 |
| S64Pa52-4-6 | Bx1 | 21–37 | 5. 1 | 6. 5 | 11. 7 | 18. 5 | 15. 0 | 32. 1 |
| S64Pa52-4-7 | Bx2 | 37–58 | 4. 8 | 5. 7 | 10. 7 | 21. 2 | 21. 3 | 28. 4 |
| Tioga: | | | | | | | | |
| S64Pa52-7-1 | Ap | 0–13 | 0 | . 2 | 6. 3 | 45. 6 | 30. 7 | 13. 4 |
| S64Pa52-7-2 | C1 | 13–16 | 0 | . 1 | . 7 | 32. 3 | 44. 4 | 18. 9 |
| S64Pa52-7-3 | C2 | 16–18 | 0 | 0 | 1. 5 | 42. 4 | 33. 5 | 18. 0 |
| S64Pa52-7-4 | C3 | 18–21 | 0 | 0 | . 6 | 40. 7 | 42. 0 | 11. 4 |
| S64Pa52-7-5 | C4 | 21–24 | 0 | 0 | . 5 | 32. 2 | 40. 5 | 21. 9 |
| S64Pa52-7-6 | C5 | 24–28 | 0 | . 1 | . 8 | 26. 1 | 39. 8 | 26. 5 |
| S64Pa52-7-7 | C6 | 28–35 | 0 | . 1 | 1. 0 | 21. 7 | 37. 6 | 34. 0 |
| S64Pa52-7-8 | C7 | 35–47 | 0 | . 1 | 1. 3 | 20. 8 | 37. 5 | 34. 5 |
| S64Pa52-7-9 | C8 | 47–67 | 0 | . 1 | 2. 4 | 21. 8 | 35. 7 | 31. 6 |
| S64Pa52-7-10 | C9 | 67–84 | 0 | . 7 | 7. 5 | 17. 7 | 28. 5 | 33. 2 |
| S64Pa52-7-11 | C10 | 84–94 | . 1 | 4. 5 | 29. 0 | 16. 5 | 17. 8 | 25. 5 |
| S64Pa52-7-12 | C11 | 94–104 | . 1 | 5. 5 | 41. 9 | 23. 4 | 12. 4 | 12. 8 |
| S64Pa52-7-13 | C12 | 104–154 | 0 | 1. 0 | 12. 5 | 34. 6 | 25. 6 | 21. 7 |
| Wurtsboro: | | | | | | | | |
| S64Pa52-2-1 | A2 | 0–1 | . 1 | 2. 3 | 7. 9 | 17. 4 | 16. 6 | 44. 9 |
| S64Pa52-2-2 | B2ir | 1–5 | . 8 | 3. 0 | 8. 1 | 15. 9 | 16. 8 | 41. 3 |
| S64Pa52-2-3 | B21 | 5–11 | 3. 0 | 3. 1 | 9. 9 | 18. 0 | 16. 9 | 38. 9 |
| S64Pa52-2-4 | B22 | 11–15 | 3. 4 | 5. 3 | 9. 3 | 16. 5 | 16. 2 | 38. 3 |
| S64Pa52-2-5 | B22 | 15–20 | 3. 4 | 5. 0 | 10. 3 | 17. 1 | 15. 4 | 36. 4 |
| S64Pa52-2-6 | Bx1 | 20–28 | 4. 4 | 5. 6 | 10. 1 | 17. 6 | 16. 5 | 36. 6 |
| S64Pa52-2-7 | Bx2 | 28–36 | 5. 7 | 6. 1 | 11. 5 | 17. 9 | 15. 2 | 33. 8 |
| S64Pa52-2-8 | Bx3 | 36–48 | 2. 9 | 5. 1 | 10. 4 | 18. 0 | 16. 3 | 31. 7 |
| S64Pa52-2-9 | Bx4 | 48–56 | 5. 0 | 4. 4 | 8. 6 | 14. 6 | 13. 4 | 34. 4 |

[1] Determinations not made.
[2] Bulk density determined by the excavation method.

the interstratified minerals were inherited from the alluvial sediments, although they may have been formed since the deposition.

*Wurtsboro very stony sandy loam.*—In the Wurtsboro profile there is little or no evidence of accumulated clay in the B horizon. The bulk density of 1.80 to 2.09 in the Bx horizons confirms the field judgment that these horizons are fragipan. In the profile reported and in another sampled for analysis the distribution of coarse fragments shows no pattern. The amount of coarse fragments ranges from 5 percent to 31 percent in this profile, and to 54 percent in the B21 horizon of another profile. The high content of coarse fragments, the sandy texture, and the density of the fragipan all reduce the capacity to hold moisture that is available to plants.

The Wurtsboro soils developed under forests, and the

*physical properties of selected soils*

Absence of an entry indicates determination was not made or the material was not present.]

| Particle-size distribution—Continued: Fine silt (0.005 to 0.002 mm.) | Particle-size distribution—Continued: Clay (less than 0.002 mm.) | Coarse fragments (greater than 2.0 mm.) | Textural class (based on laboratory data) | Bulk density (1-inch core) | Moisture held at—: Tension of ⅓ atmosphere (core) | Moisture held at—: Tension of 15 atmospheres (fragments) | Available moisture capacity |
|---|---|---|---|---|---|---|---|
| *Percent* | *Percent* | *Percent* | | *Gm./cc.* | *Percent* | *Percent* | *Inches per inch* |
| 4.0 | 14.0 | 15 | Loam | (1) | (1) | 14.8 | ---------- |
| 6.8 | 9.9 | 70 | Fine sandy loam | 0.92 | 29.0 | 9.8 | 0.19 |
| 5.2 | 9.0 | 75 | Sandy loam | 1.15 | 24.3 | 6.8 | .20 |
| 2.7 | 7.0 | 69 | Coarse sandy loam | 1.55 | 12.4 | 4.1 | .13 |
| .9 | 2.1 | 59 | Coarse sandy loam | 1.71 | 4.8 | 1.7 | .05 |
| .7 | .9 | 61 | Coarse sandy loam | 1.72 | 3.6 | 1.3 | .04 |
| | | | | | | | |
| 8.5 | 13.2 | 64 | Silt loam | (1) | (1) | 24.7 | ---------- |
| 8.8 | 13.2 | 70 | Silt loam | (1) | (1) | 8.8 | ---------- |
| 7.6 | 15.4 | 60 | Silt loam | [2] 1.69 | (1) | 8.3 | .27 |
| 5.2 | 13.1 | 84 | Loam | (1) | (1) | 7.6 | ---------- |
| 2.4 | 7.6 | 86 | Coarse sandy loam | (1) | (1) | 5.7 | ---------- |
| | | | | | | | |
| 2.2 | 4.5 | 18 | Fine sandy loam | (1) | (1) | 11.5 | ---------- |
| 2.8 | 6.2 | 50 | Fine sandy loam | .93 | 25.9 | 7.7 | .17 |
| 2.6 | 7.1 | 48 | Fine sandy loam | 1.32 | 15.7 | 4.4 | .15 |
| 5.0 | 7.1 | 62 | Fine sandy loam | 1.51 | 13.2 | 3.3 | .15 |
| 3.5 | 5.9 | 26 | Fine sandy loam | 1.60 | 12.1 | 2.1 | .16 |
| 3.5 | 7.6 | 37 | Fine sandy loam | 1.73 | 10.1 | 2.5 | .13 |
| 3.4 | 4.5 | ---------- | Fine sandy loam | 1.68 | 8.0 | 1.5 | .11 |
| | | | | | | | |
| .6 | 3.2 | 0 | Loamy fine sand | 1.44 | 7.9 | 2.2 | .08 |
| .5 | 3.3 | 0 | Loamy fine sand | 1.48 | 8.7 | 2.1 | .10 |
| 1.7 | 2.9 | 0 | Loamy fine sand | 1.39 | 7.7 | 2.1 | .08 |
| 4.0 | 1.3 | 0 | Loamy fine sand | 1.38 | 8.0 | 2.0 | .08 |
| <.1 | 4.9 | 0 | Very fine sandy loam | 1.25 | 9.2 | 2.3 | .09 |
| 2.3 | 4.4 | 0 | Very fine sandy loam | 1.25 | 13.0 | 3.5 | .12 |
| 1.5 | 4.1 | 0 | Very fine sandy loam | 1.30 | 14.0 | 2.8 | .15 |
| .6 | 5.2 | 0 | Very fine sandy loam | 1.36 | 11.6 | 2.7 | .12 |
| .9 | 7.5 | 0 | Very fine sandy loam | 1.38 | 15.8 | 4.2 | .16 |
| 6.1 | 6.3 | 0 | Very fine sandy loam | 1.42 | 16.9 | 5.5 | .16 |
| 1.2 | 5.4 | 0 | Sandy loam | 1.47 | 15.2 | 4.2 | .16 |
| .7 | 3.2 | 0 | Loamy sand | 1.43 | 6.9 | 1.0 | .08 |
| 1.9 | 2.7 | 0 | Loamy fine sand | 1.50 | 9.1 | 1.5 | .12 |
| | | | | | | | |
| 5.1 | 5.7 | 5 | Silt loam | (1) | (1) | 11.9 | ---------- |
| 5.6 | 8.5 | 13 | Loam | .94 | 40.7 | 13.3 | .26 |
| 5.2 | 5.0 | 18 | Fine sandy loam | 1.24 | 23.9 | 7.9 | .20 |
| 5.3 | 5.7 | 23 | Fine sandy loam | 1.36 | 19.6 | 3.9 | .21 |
| 6.5 | 5.9 | 30 | Fine sandy loam | 1.79 | 13.4 | 2.4 | .20 |
| 3.3 | 5.9 | 24 | Fine sandy loam | 1.87 | 12.2 | 2.7 | .18 |
| 3.8 | 6.0 | 22 | Fine sandy loam | 1.81 | 11.7 | 3.1 | .16 |
| 7.3 | 8.3 | 31 | Fine sandy loam | 1.80 | 11.1 | 2.8 | .15 |
| 5.6 | 14.0 | 17 | Loam | 2.09 | 10.7 | 4.4 | .13 |

content of organic matter is greatest in the O horizons. The amount is much less in the upper mineral soil (A2 horizon), and it decreases rapidly with depth. The cation-exchange capacity is low, except in the surface layers that contain organic matter. The reaction is very strongly acid to extremely acid.

The clay minerals are dominated by illite and chlorite. The amount of illite increases with depth; that of chlorite is fairly constant. The content of vermiculite and of interstratified clay minerals decreases with depth, indicating that these minerals were formed by weathering. Montmorillonite is present in fairly large amounts.

## General Nature of the County

This section gives some facts about the county. It describes the physiography, relief, geology, and climate. It

TABLE 12.—*Chemical*

[Laboratory analyses made at the Soil Characterization Laboratory of the Pennsylvania State

| Soil name and sample number | Horizon | Depth | Organic carbon | Nitrogen | Carbon-nitrogen ratio | Extractable cations (milliequivalents per 100 grams of soil) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Calcium | Magnesium | Sodium | Potassium | Hydrogen (exchange acidity) |
| | | *Inches* | *Percent* | *Percent* | | | | | | |
| Chenango: | | | | | | | | | | |
| S64Pa52-3-00 | O1 | 2–1 | 49.00 | 1.30 | 38 | --- | --- | --- | --- | --- |
| S64Pa52-3-0 | O2 | 1–0 | 17.41 | .71 | 24 | --- | --- | --- | --- | --- |
| S64Pa52-3-1 | A2 | 0–2 | 6.44 | .24 | 27 | 1.0 | 0.6 | 0.1 | 0.2 | 38.1 |
| S64Pa52-3-2 | B2ir | 2–4 | 2.98 | .13 | 23 | 2.4 | 1.4 | .1 | .3 | 19.8 |
| S64Pa52-3-3 | B21 | 4–9 | 1.41 | .06 | 24 | <.1 | .7 | .1 | .2 | 8.8 |
| S64Pa52-3-4 | B22 | 9–16 | .55 | .04 | 14 | <.1 | .5 | .1 | .2 | 3.5 |
| S64Pa52-3-5 | IIB23 | 16–26 | .20 | --- | --- | <.1 | .1 | .1 | .1 | .4 |
| S64Pa52-3-6 | IIC | 26–50 | .09 | --- | --- | <.1 | .5 | .1 | .1 | .3 |
| Manlius: | | | | | | | | | | |
| S64Pa52-6-1 | O1 | 1½–½ | 48.27 | .89 | 54 | --- | --- | --- | --- | --- |
| S64Pa52-6-2 | O2 | ½–0 | 33.98 | 1.36 | 25 | --- | --- | --- | --- | --- |
| S64Pa52-6-3 | A1 | 0–3 | 7.94 | .44 | 18 | 1.0 | <.1 | .1 | .5 | 40.8 |
| S64Pa52-6-4 | A2 | 3–8 | 3.04 | .16 | 19 | .2 | <.1 | .1 | .3 | 21.5 |
| S64Pa52-6-5 | B2 | 8–19 | .95 | .07 | 14 | .3 | <.1 | .1 | .2 | 12.9 |
| S64Pa52-6-6 | B3 | 19–25 | .84 | .07 | 12 | .4 | .2 | .1 | .3 | 11.9 |
| S64Pa52-6-7 | C | 25–30 | .59 | .04 | 15 | .4 | <.1 | .1 | .2 | 9.3 |
| Swartswood: | | | | | | | | | | |
| S64Pa52-4-00 | O1 | 2–1 | --- | 1.43 | --- | --- | --- | --- | --- | --- |
| S64Pa52-4-0 | O2 | 1–0 | 20.78 | .80 | 26 | --- | --- | --- | --- | --- |
| S64Pa52-4-1 | A2 | 0–2 | 5.66 | .13 | 44 | .1 | .5 | .1 | .3 | 15.5 |
| S64Pa52-4-2 | B2ir | 2–7 | 3.03 | .11 | 28 | <.1 | .5 | .1 | .2 | 14.7 |
| S64Pa52-4-3 | B21 | 7–12 | 1.04 | .06 | 17 | .1 | .5 | .1 | .2 | 3.7 |
| S64Pa52-4-4 | B22 | 12–18 | .28 | .04 | 7 | <.1 | .5 | .1 | .1 | 3.5 |
| S64Pa52-4-5 | B23 | 18–21 | .09 | --- | --- | .7 | .9 | .8 | .2 | 3.1 |
| S64Pa52-4-6 | Bx1 | 21–37 | .06 | --- | --- | .7 | .3 | <.1 | .1 | 5.4 |
| S64Pa52-4-7 | Bx2 | 37–58 | .03 | --- | --- | .3 | <.1 | <.1 | .1 | 3.1 |
| Tioga | | | | | | | | | | |
| S64Pa52-7-1 | Ap | 0–13 | .47 | .05 | 9 | 2.8 | <.1 | <.1 | .2 | 2.3 |
| S64Pa52-7-2 | C1 | 13–16 | .20 | .03 | --- | 1.8 | <.1 | <.1 | .1 | 1.8 |
| S64Pa52-7-3 | C2 | 16–18 | .17 | .04 | --- | 1.9 | <.1 | <.1 | .1 | 2.0 |
| S64Pa52-7-4 | C3 | 18–21 | .13 | .01 | --- | 1.8 | <.1 | <.1 | .2 | 2.3 |
| S64Pa52-7-5 | C4 | 21–24 | .17 | <.01 | --- | 1.8 | <.1 | <.1 | .2 | 2.3 |
| S64Pa52-7-6 | C5 | 24–28 | .20 | --- | --- | 2.2 | <.1 | <.1 | .3 | 2.7 |
| S64Pa52-7-7 | C6 | 28–35 | .13 | --- | --- | 1.7 | <.1 | <.1 | .1 | 2.3 |
| S64Pa52-7-8 | C7 | 35–47 | .13 | --- | --- | 1.6 | <.1 | .1 | .1 | 2.3 |
| S64Pa52-7-9 | C8 | 47–67 | .12 | --- | --- | 1.5 | .2 | <.1 | .1 | 3.7 |
| S65Pa52-7-10 | C9 | 67–84 | .12 | --- | --- | .9 | <.1 | .1 | .1 | 4.8 |
| S64Pa52-7-11 | C10 | 84–94 | .10 | --- | --- | .5 | <.1 | .1 | .1 | 4.7 |
| S64Pa52-7-12 | C11 | 94–104 | .07 | --- | --- | .5 | <.1 | <.1 | .1 | 2.8 |
| S64Pa52-7-13 | C12 | 104–154 | .08 | --- | --- | .6 | <.1 | <.1 | .1 | 5.2 |
| Wurtsboro: | | | | | | | | | | |
| S64Pa52-2-00 | O1 | 3–1 | 41.35 | .95 | 44 | --- | --- | --- | --- | --- |
| S64Pa52-2-0 | O2 | 1–0 | 35.21 | 1.29 | 27 | --- | --- | --- | --- | --- |
| S64Pa52-2-1 | A2 | 0–1 | 5.79 | .07 | 79 | <.1 | .3 | .1 | .2 | 29.5 |
| S64Pa52-2-2 | B2ir | 1–5 | 4.82 | .06 | 75 | <.1 | .3 | .1 | .2 | 25.7 |
| S64Pa52-2-3 | B21 | 5–11 | 1.75 | .05 | 34 | <.1 | .3 | .1 | .1 | 14.7 |
| S64Pa52-2-4 | B22 | 11–15 | .49 | .02 | 21 | .1 | .6 | .1 | .1 | 7.4 |
| S64Pa52-2-5 | B22 | 15–20 | .16 | .02 | --- | .1 | .5 | .1 | .1 | 5.7 |
| S64Pa52-2-6 | Bx1 | 20–28 | .09 | .02 | --- | .1 | 1.0 | .1 | .1 | 3.7 |
| S64Pa52-2-7 | Bx2 | 28–36 | .17 | --- | --- | <.1 | 1.4 | .1 | .1 | 1.3 |
| S64Pa52-2-8 | Bx3 | 36–48 | .16 | --- | --- | <.1 | .9 | .1 | .1 | .9 |
| S64Pa52-2-9 | Bx4 | 48–56 | .07 | --- | --- | .1 | .7 | .1 | .2 | .3 |

*properties of selected soils*

University. Absence of data indicates the determination not made or the material not present]

| Cation-exchange capacity (sum) | Base saturation (sum) | Reaction, field (electrometric) | Free iron oxides ($Fe_2O_3$) | Mineral composition of clay fraction | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Kaolinite | Illite | Vermiculite | Chlorite | Montmorillonite | Interstratified minerals |
| *Meq./100 gm.* | *Percent* | *pH* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| ----- | ----- | 3.9 | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| ----- | ----- | 4.0 | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 40.0 | 5 | 3.9 | 1.5 | 10.0 | 15.0 | 55.0 | ----- | 15.0 | 5.0 |
| 24.0 | 18 | 4.6 | 2.2 | 5.0 | 10.0 | 10.0 | 15.0 | 5.0 | 55.0 |
| 9.9 | 11 | 4.9 | 1.9 | 5.0 | 15.0 | 10.0 | 15.0 | 5.0 | 50.0 |
| 4.4 | 21 | 4.5 | 1.4 | ----- | 20.0 | 30.0 | 20.0 | 5.0 | 25.0 |
| .8 | 50 | 4.6 | .9 | 5.0 | 35.0 | 15.0 | 25.0 | 10.0 | 10.0 |
| 1.1 | 73 | 4.6 | .8 | 30.0 | 40.0 | 10.0 | 10.0 | 5.0 | 5.0 |
| ----- | ----- | 3.8 | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| ----- | ----- | 3.9 | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 42.5 | 4 | 4.2 | 1.7 | ----- | 25.0 | 35.0 | 15.0 | ----- | 25.0 |
| 22.2 | 3 | 4.4 | 1.9 | ----- | 20.0 | 25.0 | 15.0 | ----- | 40.0 |
| 13.6 | 5 | 4.4 | 2.1 | ----- | 25.0 | 30.0 | 20.0 | ----- | 25.0 |
| 12.9 | 8 | 4.8 | 1.8 | ----- | 30.0 | 25.0 | 20.0 | ----- | 25.0 |
| 10.1 | 8 | 4.8 | 1.3 | ----- | 40.0 | 20.0 | 25.0 | ----- | 15.0 |
| ----- | ----- | 4.0 | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| ----- | ----- | 3.8 | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 16.5 | 6 | 3.8 | .5 | 5.0 | 40.0 | ----- | 5.0 | 40.0 | 10.0 |
| 15.6 | 6 | 4.5 | 2.0 | 5.0 | 40.0 | 30.0 | 10.0 | 10.0 | 5.0 |
| 4.6 | 20 | 4.4 | 1.3 | 5.0 | 40.0 | 25.0 | 15.0 | 5.0 | 10.0 |
| 4.3 | 19 | 4.6 | 1.3 | ----- | 40.0 | 30.0 | 20.0 | ----- | 10.0 |
| 5.7 | 46 | 4.5 | .8 | ----- | 50.0 | 20.0 | 20.0 | ----- | 10.0 |
| 6.6 | 18 | 4.5 | 1.0 | ----- | 60.0 | 10.0 | 20.0 | ----- | 10.0 |
| 3.7 | 16 | 4.6 | .6 | ----- | 65.0 | 5.0 | 20.0 | ----- | 10.0 |
| 5.5 | 58 | 6.4 | .6 | ----- | 60.0 | 10.0 | 25.0 | ----- | 5.0 |
| 3.9 | 54 | 6.6 | .6 | ----- | ----- | ----- | ----- | ----- | ----- |
| 4.2 | 52 | 7.0 | .6 | ----- | 60.0 | 15.0 | 20.0 | ----- | 5.0 |
| 4.5 | 49 | 7.0 | .7 | ----- | ----- | ----- | ----- | ----- | ----- |
| 4.5 | 49 | 6.6 | .8 | ----- | ----- | ----- | ----- | ----- | ----- |
| 5.4 | 50 | 6.8 | 1.0 | ----- | 60.0 | 20.0 | 15.0 | ----- | 5.0 |
| 4.3 | 47 | 7.0 | .8 | ----- | ----- | ----- | ----- | ----- | ----- |
| 4.2 | 45 | 6.9 | .7 | ----- | ----- | ----- | ----- | ----- | ----- |
| 5.6 | 40 | 6.8 | 1.0 | ----- | 60.0 | 10.0 | 20.0 | ----- | 10.0 |
| 6.0 | 20 | 5.2 | 1.0 | ----- | ----- | ----- | ----- | ----- | ----- |
| 5.5 | 14 | 5.1 | .7 | ----- | ----- | ----- | ----- | ----- | ----- |
| 3.5 | 20 | 5.0 | .6 | ----- | 60.0 | 5.0 | 25.0 | ----- | 5.0 |
| 6.1 | 15 | 5.2 | .8 | ----- | ----- | ----- | ----- | ----- | ----- |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 30.2 | 2 | 3.3 | 1.4 | ----- | 30.0 | ----- | ----- | 60.0 | 10.0 |
| 26.4 | 3 | 4.1 | 1.9 | ----- | 30.0 | 40.0 | 5.0 | 20.0 | 10.0 |
| 15.3 | 4 | 4.5 | 1.5 | ----- | 25.0 | 40.0 | 15.0 | 10.0 | 10.0 |
| 8.3 | 11 | 4.4 | 1.4 | ----- | 40.0 | 25.0 | 20.0 | 5.0 | 10.0 |
| 6.5 | 12 | 4.3 | 1.0 | ----- | 55.0 | 10.0 | 20.0 | 10.0 | 5.0 |
| 5.0 | 26 | 4.5 | .8 | ----- | 55.0 | 15.0 | 20.0 | ----- | 10.0 |
| 3.0 | 57 | 4.4 | .8 | ----- | 65.0 | ----- | 20.0 | 10.0 | 5.0 |
| 2.1 | 57 | 4.2 | .8 | ----- | 75.0 | 5.0 | 20.0 | ----- | ----- |
| 1.4 | 79 | 4.8 | 1.0 | ----- | 75.0 | 5.0 | 15.0 | ----- | 5.0 |

also tells about the agriculture and the transportation. The statistics given are mainly from reports of the U.S. Census of Agriculture.

## Physiography and Relief

Pike County lies on the southern edge of the Appalachian Plateau, southeast of the hard-coal fields of Pennsylvania. An escarpment along the Delaware River on the eastern side of the county is the northern end of the Allegheny front, which extends northeast from Alabama across the Middle Atlantic States. The structural geology of Pike County is generally monoclinal, and the rocks dip toward the northwest. The Devonian sandstone and shale beds that are exposed here are beneath the anthracite coal beds to the northwest. The action of geologic erosion has given the area a corrugated, or washboard, appearance when it is viewed from a distance. This appearance is most pronounced along the eastern side of the county, where the monoclinal ridges appear like steps that are almost horizontal. These steplike ridges can be seen readily from either the Dry Meadow or the High Knob fire tower.

The relief of Pike County is mild, except for steep escarpments that were cut by the Delaware and Lackawaxen Rivers. The strongest slopes on the plateau are the eastern faces of the ridges. Glaciation disrupted the drainage system in the county by filling in most of the preglacial valleys and generally smoothing the landscape. The glaciation produced shallow natural lakes, swampy uplands, and shallow, wet flood plains. Many of the low areas have been dammed to produce lakes for recreational uses.

## Bedrock Geology

Pike County is underlain by rocks of Devonian Age, the Catskill formation, the Hamilton group, and the Devonian marine beds. The Catskill formation is exposed over nearly all of the county, except in a narrow belt along the southeastern edge and in the valley of the Delaware River. It consists of red, gray, and brown shale and sandstone. In the western one-fourth of the county, the bedrock of the Catskill formation is red shale and sandstone and the reddish soils of the Culvers, Cattaraugus, and Morris soils of association 5, shown on the general soil map, are dominant. In the remaining three-fourths of the county, the bedrock is gray shale and sandstone and the dominant soils are brownish.

A very narrow band of marine beds of the Devonian period is exposed at the eastern edge of the Catskill formation. These beds consist of gray to olive-brown shale, graywacke, and sandstone and include the Chemung and the Portage groups.

East of the marine beds, extending to the Delaware River bluffs and to the river itself, the shales of the Hamilton group are exposed. This group includes the Mahantango formation, which consists of brown to olive shale and interbedded sandstone; the Marcellus formation, which consists of black, fissile, carbonaceous shale; and the Onondaga formation, which consists of greenish-blue, thin-bedded shale and dark-blue to black, medium-bedded limestone.

## Glacial Geology

Pike County was covered by at least two great continental ice sheets. The most recent one, called the Wisconsin glacier, retreated about 12,000 to 14,000 years ago. Features typical of a glaciated landscape, such as drumlins, eskers, and terminal moraines, are not conspicuous. There are, however, some small gravelly kames adjoining depressions on the plateau. Many of the small valleys are filled with glacial drift. The river valleys are filled with stratified sand and gravel in which the content of silt and clay is low. These materials were laid down in rapidly running water that carried away the finer materials.

The gravelly deposits provided the parent material for such soils as the Atherton, Braceville, Chenango, Red Hook, and Tunkhannock. The sandy deposits were parent material for the Middlebury and Tioga soils.

Generally, throughout the uplands the glacial material was derived from the preglacial soils and from rocky materials that were broken off and ground up by the glaciers. The loose material was overridden by the glaciers, and some of it was carried in the glaciers and dropped when the ice melted, leaving the surface covered by unconsolidated deposits that had been derived mainly from the local bedrock. These deposits range in thickness from a few inches to hundreds of feet. Where the bedrock was red, the glacial till consists mainly of fragments of red rocks and the soils that formed are mainly reddish soils, such as those of the Cattaraugus, Culvers, Morris, and Oquaga series. Where the rocks were predominantly gray, brownish soils, such as those of the Dekalb, Mardin, Swartswood, Volusia, and Wurtsboro series, are most common. The flood plains of the county consist of deposits of recent alluvium, and the principal soils on them are those of the Holly, Middlebury, Papakating, and Tioga series. Where the till was thin or absent, soils of the Dekalb, Manlius, and Oquaga series are common.

Muck and Peat occur in the many kettles and closed depressions that were formed when the ice melted or the stream valley became blocked. These depressions were filled with water; plants grew and died in them; and organic remains accumulated in some places to a thickness of tens of feet.

The time since the Wisconsin glacier retreated and exposed these materials to weathering and soil formation has been so short that only indistinct soil horizons have formed. There is very little evidence of the formation and movement of clay in the soils formed in glacial till. Iron compounds have been oxidized, however, and enough weathering has taken place to form weakly expressed soil colors that differ from those of the glacial till.

## Climate [5]

The climate of Pike County is one of long, cold winters and pleasantly mild summers. An ample supply of precipitation is received throughout the year. Since prevailing winds are from the west, most weather systems affecting this area originate in continental regions. As a result, Pike

[5] Prepared by NELSON M. KAUFFMAN, State climatologist, U.S. Weather Bureau, Environmental Science Services Administration, Harrisburg, Pa.

County is subject to a wide variety of weather. Temperature and other atmospheric conditions change from day to day and from week to week. Seasonal weather varies from year to year. Periodically, however, weather conditions persist with little alteration for periods from a few days to a week or more. Several successive days of rather warm temperatures in summer and of near-zero cold in winter are not uncommon. One climatic feature of considerable persistence is that of cloudy skies during winter and early in spring.

Climatic variations within the county are chiefly the result of local differences in topography and elevation. Marked differences over a short distance can produce significant modifications of the macroclimate. The average temperature tends to be somewhat higher and the precipitation less in the valleys than at the high elevations. One exception to this rule is the temperature situation that develops, particularly on calm, clear nights, when, as a result of the drainage of cool air, the lowest temperatures occur in valleys and other low spots. Freezing temperatures, therefore, occur in the valleys somewhat later in spring and earlier in fall than on the surrounding hillsides. Consequently, the growing season is somewhat shorter in the valleys than on some of the hills.

Since there are no long-term records of temperature and precipitation in Pike County, data collected at Mount Pocono in adjacent Monroe County are shown in tables 13 and 14. This station is at an elevation of 1,915 feet, and therefore is representative of only the highest areas in Pike County. Making some allowances for the difference in elevation, however, the data can be used with discretion for planning purposes. Fairly wide deviations from the given

TABLE 13.—*Temperature and precipitation at Mount Pocono, Pa.*

| Month | Temperature | | | | Precipitation | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Average daily maximum | Average daily minimum | Average extreme maximum | Average extreme minimum | Average total | One year in 10 will have— Less than— | One year in 10 will have— More than— | Snow: Average monthly total | Snow: Average number of days with depth of— 1 inch or more | Snow: Average number of days with depth of— 6 inches or more |
| | ° F. | ° F. | ° F. | ° F. | Inches | Inches | Inches | Inches | | |
| January | 31 | 16 | 51 | −3 | 3. 6 | 1. 4 | 5. 9 | 13. 6 | 17 | 4 |
| February | 32 | 15 | 51 | −3 | 3. 1 | 1. 6 | 4. 9 | 13. 1 | 16 | 7 |
| March | 41 | 22 | 62 | 5 | 4. 5 | 2. 7 | 7. 0 | 12. 2 | 12 | 6 |
| April | 54 | 34 | 77 | 19 | 4. 3 | 1. 8 | 6. 2 | 3. 3 | 3 | 1 |
| May | 66 | 43 | 83 | 28 | 4. 5 | 1. 7 | 6. 7 | . 1 | 0 | 0 |
| June | 74 | 52 | 86 | 38 | 4. 3 | 2. 7 | 6. 5 | 0 | 0 | 0 |
| July | 78 | 56 | 87 | 43 | 5. 2 | 2. 4 | 11. 6 | 0 | 0 | 0 |
| August | 76 | 55 | 86 | 41 | 5. 3 | 1. 6 | 9. 3 | 0 | 0 | 0 |
| September | 69 | 48 | 81 | 31 | 4. 4 | 1. 8 | 10. 5 | (1) | 0 | 0 |
| October | 60 | 39 | 77 | 23 | 4. 3 | 1. 9 | 8. 4 | . 3 | (2) | 0 |
| November | 46 | 28 | 66 | 10 | 4. 3 | 2. 0 | 6. 4 | 4. 7 | 4 | 0 |
| December | 33 | 18 | 54 | −3 | 4. 0 | 1. 6 | 8. 3 | 8. 2 | 15 | 4 |
| Year | 55 | 36 | (3) 95 | (4) −25 | 51. 8 | 23. 2 | 91. 7 | 55. 5 | 67 | 22 |

[1] Trace.
[2] Less than 0.5 day.
[3] Highest maximum during period 1931–1960.
[4] Lowest minimum during period 1931–1960.

TABLE 14.—*Probabilities of last freezing temperature in spring and first in fall at Mount Pocono, Pa.*

| Probability | Dates for given probability for temperature of— 16° F. or lower | 20° F. or lower | 24° F. or lower | 28° F. or lower | 32° F. or lower |
|---|---|---|---|---|---|
| Spring: | | | | | |
| 1 year in 10 later than | April 12 | April 22 | April 27 | May 24 | June 4 |
| 2 years in 10 later than | April 6 | April 16 | April 23 | May 17 | May 29 |
| 5 years in 10 later than | March 24 | April 4 | April 12 | May 5 | May 18 |
| Fall: | | | | | |
| 1 year in 10 earlier than | November 2 | October 20 | October 11 | September 27 | September 17 |
| 2 years in 10 earlier than | November 7 | October 26 | October 17 | October 3 | September 20 |
| 5 years in 10 earlier than | November 18 | November 6 | October 27 | October 14 | September 29 |

data are likely to occur only in the valley of the Delaware River.

### *Temperature*

The warmest part of the county is along the Delaware River, where the average annual temperature is 49° F. The average annual temperature in the central and northern parts of the county is several degrees lower. In the Pocono Mountain area, which is the southwestern part of the county, the annual average is around 45°. January is normally the coldest month, with a mean temperature of 24° to 27°, and July is the warmest, when the mean is 67° to 71°. A temperature differential of 3° to 4° is normally maintained between the valley of the Delaware River and the rest of the county throughout the year.

The temperature usually remains above 50° only during June, July, and August, and rises to 90° or higher on an average of 20 days in the valley of the Delaware River but on only a few days at the high elevations. From late October through early April, the minimum temperature drops below freezing across the county on 150 to 160 days. From December through February, the temperature drops to zero or lower on an average of 3 days per month.

The interval between the last temperature of 32° in spring and the first in fall is known as the growing season. It normally extends from mid-May to late September, and ranges from 127 days in the valley of the Delaware River to 134 days elsewhere in the county. Variations from year to year are appreciable, and the growing season has ranged from 110 to 165 days during the period of record. Table 14 gives the probabilities that the last temperature in spring of 16°, 20°, 24°, 28°, and 32° will occur at Mount Pocono after the dates specified, and also the probabilities that the same temperatures in fall will occur before the dates specified. These data from Mount Pocono can be applied to areas in Pike County where elevation and air drainage are similar. Elsewhere, as in the valley of the Delaware River, the growing season is about 7 days shorter and the probable dates of the given minimum temperatures are correspondingly later in spring and earlier in fall.

### *Precipitation*

The average annual precipitation ranges from 44 inches in the valley of the Delaware River to 47 inches in the southwestern part of the county. The total amount in 1 year, however, has ranged from 33 inches to 61 inches during the period of record. Nearly half the annual total normally falls during the months from May through September, although the amount in those months has ranged from less than 11 inches to nearly 29 inches. Precipitation normally is evenly distributed throughout the year, and the average monthly amount ranges from 3 to 5 inches. Fluctuations in weather patterns, however, have resulted in monthly totals of less than 0.1 inch and of nearly 19 inches. The latter amount was produced in one of the hurricanes that infrequently pass through or near the area during the hurricane season from July through October. Short dry spells are likely to occur at any time, but extended severe drought is rare.

Rainfall during the warm season usually comes from showers and thunderstorms that last for only a few hours or less. Thunderstorms, about 30 to 35 of them per year, are responsible for most of the heavy short-period rainfall. Occasionally, runoff from the short storms is rapid, especially in the areas of rough terrain. Maximum amounts of 1.74 inches of rain in 1 hour and of 2.14 inches in 2 hours have been recorded in the county. Such amounts can be expected once every 5 years. Except in summer, precipitation is usually produced from general, widespread storms that yield steady but less intense rainfall for periods of 6 hours to 24 hours or more. Amounts of 1 inch per day are fairly common. Up to 2.5 inches of rainfall in 24 hours can be expected about once every 5 years.

Much of the precipitation from late November through early March falls as snow or as freezing rain. Average seasonal snowfall ranges from 44 inches in the valley of the Delaware River to nearly 50 inches in the Pocono Mountain area. The amount varies considerably from year to year and has ranged from 18 inches in the valley of the Delaware River to 80 inches in the Pocono Mountain area during the period of available records. In most winter seasons snow amounting to 35 to 60 inches can be expected throughout the county. Monthly snowfall of 10 inches or more is fairly common from December through March. Pike County is in the path of many winter storms; snowfall, therefore, is frequent, but the amount from an individual storm is usually less than 6 inches. Major storms, however, have produced as much as 10 and occasionally as much as 20 inches in 24 hours. Snow normally covers the ground to varying depths during about one-third to one-half of the winter, although in some seasons the ground is covered more or less continuously from December until early March.

## Agriculture and Transportation

Farming has always been a minor occupation in Pike County, and it has declined since 1950. The total number of farms dropped from 204 in 1959 to 100 in 1964. During the same period, the average size of farms increased from 149 acres to 168 acres.

Some comparisons of the census records of 1950 with those of 1965 show changes that have occurred in the agriculture of the county. The land in farms was reported as 39,088 acres in 1950 and as 16,775 acres in 1965. Cropland harvested declined during the same period from 6,149 acres to 2,966 acres; open pasture, from 6,960 acres to 519 acres; and all woodland in farms, from 24,060 acres to 9,781 acres. Other land in farms increased during the same period from 1,919 acres to 3,509 acres. The number of livestock on farms declined along with the acreage in crops and in pasture. The small amounts of farm products sold off the farm are marketed readily in the nearby metropolitan areas of New York City and northern New Jersey.

Transportation facilities are fair. One railroad follows the Delaware River northwest from Port Jervis, N.Y. A branch line of the same railroad follows the valley of the Lackawaxen River across the county. U.S. Highway No. 6 crosses the county from east to west, and U.S. Highway No. 209 follows the valley of the Delaware River south from Port Jervis, N.Y. Several other State roads and improved county roads cross the county and connect the small communities with the main highways.

# Glossary

**Aeration, soil.** The process by which air and other gases in the soil are exchanged with air of the atmosphere. The rate of soil aeration depends largely on the size and number of the pores in the soil and on the amount of water in the pores. A soil that has many large pores is said to be well aerated.

**Aggregate, soil.** Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

**Alluvium.** Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

**Available moisture capacity.** The capacity of a soil to hold water in a form available to plants. Amount of moisture held in a soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

**Base saturation.** The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expresssed as a percentage of the cation-exchange capacity.

**Channery soil.** A soil that contains thin, flat fragments of sandstone, limestone, or schist, as much as 6 inches in length along the longer axis. A single piece is called a fragment.

**Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter (0.000079 inch) in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt. See also Texture, soil.

**Clay film.** A coating of oriented clay particles that are commonly on the surfaces of peds and pores. The orientation of the clay is parallel to the ped surfaces, and in thin sections an abrupt boundary separates it from the unoriented matrix. Under a hand lens, the clay film appears to be smooth and wavy.

**Claypan.** A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

**Cobblestone.** A rounded or partly rounded fragment of rock, 3 to 10 inches in diameter.

**Colluvium.** Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

*Loose.*—Noncoherent; will not hold together in a mass.

*Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

*Firm.*— When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

*Sticky.*—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

*Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.

*Cemented.*—Hard and brittle; little affected by moistening.

**Contour farming.** Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to the terrace grade.

**Cover crop.** A close-growing crop grown primarily to improve and to protect the soil between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.

**Depth, soil.** In this survey soil depth refers to the depth to bedrock if the kind of limiting layer is not stated. Classes of soil depth are defined as follows:

*Deep.*—36 inches or more to bedrock.

*Moderately deep.*—20 to 36 inches to bedrock.

*Shallow.*—10 to 20 inches to bedrock.

*Very shallow.*—Less than 10 inches to bedrock.

**Drainage, soil.** (1) The removal of excess surface or ground water from a soil by means of surface or subsurface drains. (2) The effect of soil characteristics that regulate the ease or rate of natural drainage. A soil is said to be well drained when the excess water drains away readily, but not rapidly, and poorly drained when the excess water is removed so slowly that the soil remains wet a large part of the time.

**Duff.** The matted, partly decomposed organic surface layer on forested soils.

**Eluviation.** The movement of material from a soil horizon downward or laterally, in solution and, to a lesser extent, in colloidal suspension.

**Erosion.** The wearing away of the land surface by the action of water or wind.

**Esker.** A narrow, winding ridge or mound of stratified gravelly and sandy drift that was deposited by a subglacial stream.

**Field moisture capacity.** The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity, or capillary capacity.*

**Flood plain.** A nearly level area, subject to overflow unless it is protected, that occurs along a stream.

**Fragipan.** A loamy, brittle subsurface horizon that is low in content of organic matter and clay but rich in silt or very fine sand. The layer is seemingly cemented when dry, has hard or very hard consistence, and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. This layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

**Glacial outwash.** Cross-bedded gravel, sand, and silt deposited by melt water as it flowed from glacial ice.

**Glacial till.** Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

**Gleyed horizon.** A strongly mottled or gray horizon that occurs in wet soils. In the soil profile, it is designated by the symbols Ag, Bg, or Cg.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

*O horizon.*—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residue.

*A horizon.*—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active, and it is therefore marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

*B horizon.*—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused by (1) accumulation of clay, sesquioxides, humus, or some combination of these; (2) prismatic or blocky structure; (3) redder or stronger colors than the A horizon; or (4) some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

*C horizon.*—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

*R layer.*—Consolidated rock beneath the soil. In most places the rock underlies a C horizon but may be immediately beneath an A or B horizon.

**Illuvial horizon.** A horizon that has received material in solution or suspension from some other part of the soil. Because part of the fine clay in the B horizon (or subsoil) of many soils has moved into the B horizon from the A horizon, the B horizon is called an illuvial horizon.

**Infiltration.** The downward entry of water into the immediate surface of a soil or other material, as contrasted with percolation.

**Kame.** An irregular, short ridge or hill of stratified glacial drift. Most kames are interspersed with depressions, called kettles, that have no surface drainage.

**Leached layer.** A layer in which the soluble constituents have been dissolved and washed away by percolating water.

**Loam.** Soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

**Mapping unit, soil.** An area of a soil, miscellaneous land type, soil complex, undifferentiated soil group, or soil association that is enclosed by a boundary on a soil map and identified by a symbol.

**Mottled.** Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many;* size—*fine*, *medium*, and *coarse;* and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *Fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

**Munsell color notation.** A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color that has a hue of 10YR a value of 6, and a chroma of 4. Use of the Munsell system in describing color of soils is explained in the Soil Survey Manual (*14*).

**Permeability, soil.** The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows:

*Rapid.*—More than 6.3 inches per hour.
*Moderately rapid.*—2.0 to 6.3 inches per hour.
*Moderate.*—0.63 inch to 2.0 inches per hour.
*Moderately slow.*—0.20 to 0.63 inch per hour.
*Slow.*—Less than 0.2 inch per hour.

**Profile, soil.** A vertical section of the soil through all its horizons and extending into the parent material.

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

| | *pH* |
|---|---|
| Extremely acid | Below 4.5 |
| Very strongly acid | 4.5 to 5.0 |
| Strongly acid | 5.1 to 5.5 |
| Medium acid | 5.6 to 6.0 |
| Slightly acid | 6.1 to 6.5 |
| Neutral | 6.6 to 7.3 |
| Mildly alkaline | 7.4 to 7.8 |
| Moderately alkaline | 7.9 to 8.4 |
| Strongly alkaline | 8.5 to 9.0 |
| Very strongly alkaline | 9.1 and higher |

**Sand.** As a soil textural class, soil material that contains 85 percent or more sand and not more than 10 percent clay. As a soil separate, the individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters in diameter.

**Series, soil.** A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

**Silt.** As a soil textural class, soil material that contains 80 percent or more silt and less than 12 percent clay. As a soil separate, the individual mineral particles in a soil that range from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter).

**Soil association.** A group of soils, with or without characteristics in common, that occur in a characteristic geographical pattern.

**Solum.** The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in a mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

**Stripcropping.** Growing crops in a systematic arrangement of strips or bands to serve as a vegetative barrier to wind and water erosion.

**Structure, soil.** The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

**Subsoil.** Technically, the B horizon; roughly, the part of the profile below plow depth.

**Substratum.** Any layer lying beneath the solum, or true soil; the C or R horizon.

**Surface soil.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

**Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that the water may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine." See also Clay; Loam; Sand; and Silt.

**Topsoil.** A presumed fertile soil or soil material, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

**Water table.** The upper limit of the part of the soil or underlying rock material that is wholly saturated with water.

**Wilting point (or permanent wilting point).** The moisture content of a soil, on an ovendry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere. Approximately the moisture content at a tension of 15 atmospheres.

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

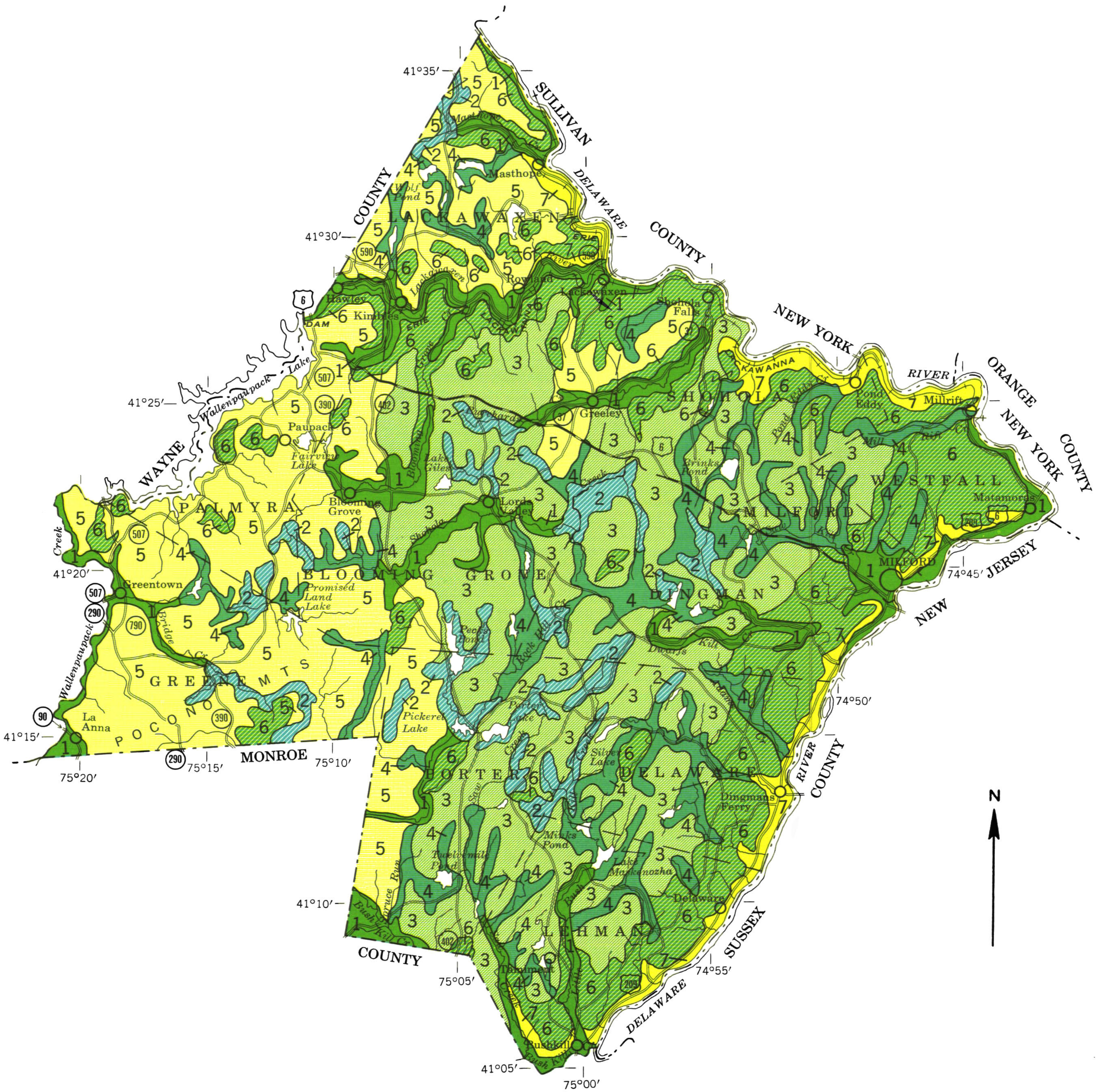
PENNSYLVANIA STATE UNIVERSITY, COLLEGE OF AGRICULTURE AND
AGRICULTURAL EXPERIMENT STATION
AND THE
PENNSYLVANIA DEPARTMENT OF AGRICULTURE
STATE SOIL AND WATER CONSERVATION COMMISSION

# GENERAL SOIL MAP

## PIKE COUNTY, PENNSYLVANIA

SCALE IN MILES

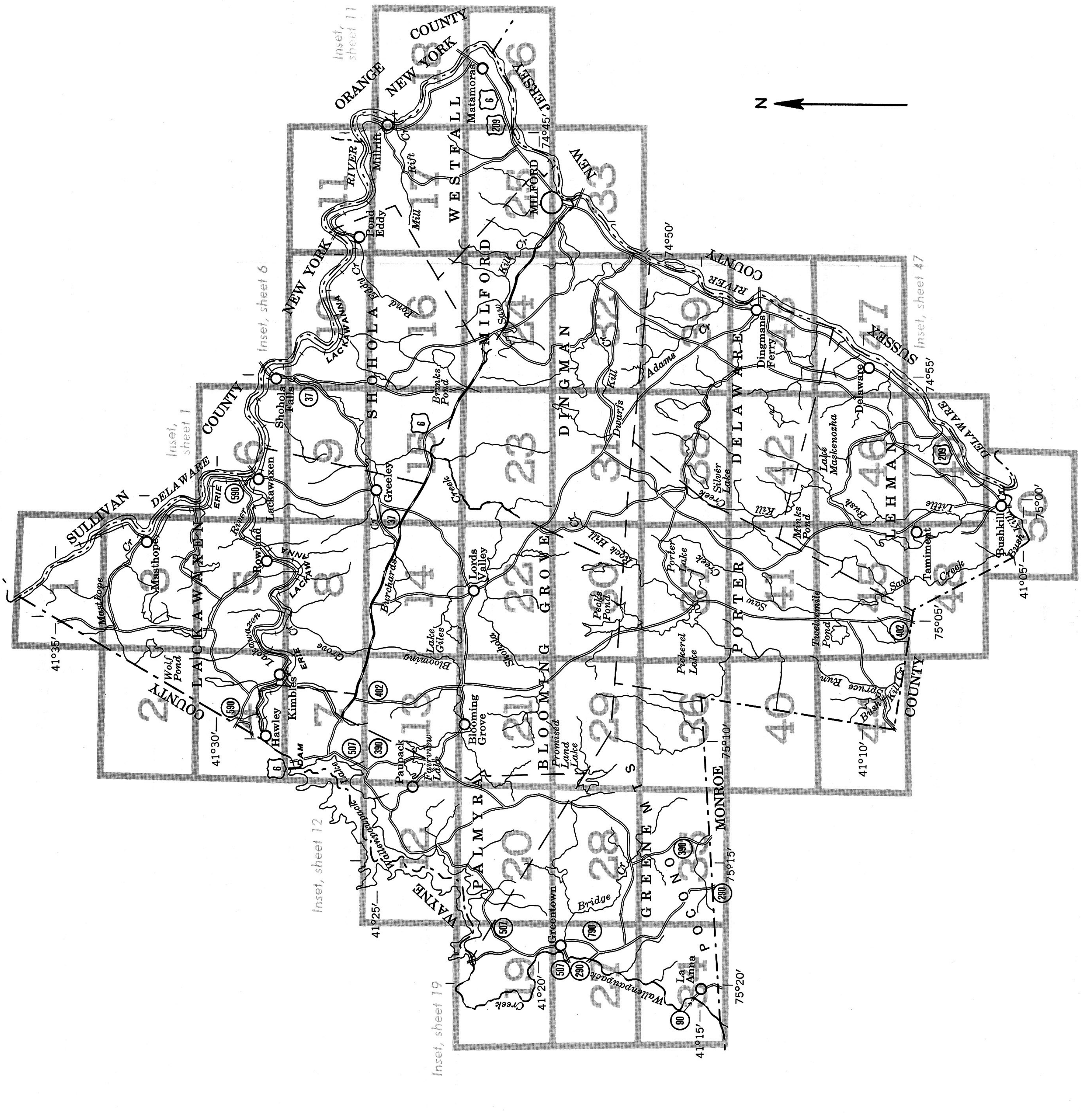
1 0 1 2 3 4




## SOIL ASSOCIATIONS

| | |
|---|---|
| 1 | Chenango-Tunkhannock-Tioga association: Deep, well-drained, nearly level to gently sloping, dominantly gravelly soils on low terraces in major stream valleys |
| 2 | Holly-Papakating-Peat and Muck association: Deep, poorly drained and very poorly drained, nearly level soils on flood plains and in upland depressions |
| 3 | Wurtsboro-Mardin-Swartswood association: Deep, moderately well drained and well drained, gently sloping to sloping, loamy soils on the uplands |
| 4 | Volusia-Tughill-Morris-Norwich association: Deep, somewhat poorly drained to very poorly drained, nearly level to sloping, loamy soils having concave slopes; in valleys and closed depressions on uplands |
| 5 | Culvers-Cattaraugus-Morris association: Deep, well-drained to somewhat poorly drained, gently sloping to moderately steep, stony and channery soils on uplands |
| 6 | Dekalb-Manlius-Oquaga association: Moderately deep and deep, well-drained, gently sloping to steep, very stony and shaly soils on uplands |
| 7 | Stony land-Rushtown association: Chiefly steep, stony and shaly areas along the river bluffs |

November 1968


N
SULLIVAN
DELAWARE
COUNTY
ORANGE
NEW YORK
COUNTY
NEW JERSEY
SUSSEX
COUNTY
MONROE
COUNTY
WAYNE
COUNTY
WESTFALL
MILFORD
SHOHOLA
LACKAWAXEN
DINGMAN
DELAWARE
LEHMAN
PORTER
BLOOMING GROVE
PALMYRA
GREENE
POCONO
Matamoras
Millrift
Pond Eddy
MILFORD
Shohola Falls
Lackawaxen
Masthope
Rowland
Greeley
Lords Valley
Hawley
Kimbles
Blooming Grove
Paupack
Greentown
La Anna
Dingmans Ferry
Delaware
Tamiment
Bushkill
Inset, sheet 1
Inset, sheet 6
Inset, sheet 11
Inset, sheet 12
Inset, sheet 19
Inset, sheet 47
41°35′
41°30′
41°25′
41°20′
41°15′
41°10′
41°05′
74°45′
74°50′
74°55′
75°00′
75°05′
75°10′
75°15′
75°20′

## SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Symbols without a slope letter are those of nearly level soils or land types. A final number, 2, in the symbol shows that the soils is moderately eroded.

| SYMBOL | NAME |
|---|---|
| At | Atherton loam |
| BrA | Braceville gravelly loam, 0 to 3 percent slopes |
| BrB2 | Braceville gravelly loam, 3 to 8 percent slopes, moderately eroded |
| CaB2 | Cattaraugus channery sandy loam, 3 to 12 percent slopes, moderately eroded |
| CaC2 | Cattaraugus channery sandy loam, 12 to 20 percent slopes, moderately eroded |
| CeB | Cattaraugus extremely stony sandy loam, 0 to 12 percent slopes |
| CeD | Cattaraugus extremely stony sandy loam, 12 to 30 percent slopes |
| CgB | Cattaraugus very stony sandy loam, 0 to 12 percent slopes |
| CgD | Cattaraugus very stony sandy loam, 12 to 30 percent slopes |
| ChB | Chenango cobbly sandy loam, 3 to 12 percent slopes |
| ChC | Chenango cobbly sandy loam, 12 to 20 percent slopes |
| ChD | Chenango cobbly sandy loam, 20 to 30 percent slopes |
| ClA | Chenango gravelly loam, 0 to 3 percent slopes |
| ClB2 | Chenango gravelly loam, 3 to 12 percent slopes, moderately eroded |
| CmB | Chenango gravelly sandy loam, 0 to 12 percent slopes |
| CmC | Chenango gravelly sandy loam, 12 to 20 percent slopes |
| CmD | Chenango gravelly sandy loam, 20 to 30 percent slopes |
| CnB2 | Culvers channery loam, 2 to 8 percent slopes, moderately eroded |
| CnC2 | Culvers channery loam, 8 to 15 percent slopes, moderately eroded |
| CuB | Culvers extremely stony loam, 0 to 8 percent slopes |
| CuD | Culvers extremely stony loam, 8 to 25 percent slopes |
| CvB | Culvers very stony loam, 0 to 8 percent slopes |
| CvC | Culvers very stony loam, 8 to 25 percent slopes |
| DeB | Dekalb extremely stony sandy loam, 0 to 12 percent slopes |
| DeD | Dekalb extremely stony sandy loam, 12 to 30 percent slopes |
| DeF | Dekalb extremely stony sandy loam, 30 to 80 percent slopes |
| DsB | Dekalb–Swartswood very stony sandy loams, 0 to 12 percent slopes |
| DsD | Dekalb–Swartswood very stony sandy loams, 12 to 30 percent slopes |
| DsF | Dekalb–Swartswood very stony sandy loams, 30 to 80 percent slopes |
| Ho | Holly silt loam |
| MaB | Manlius rocky silt loam, 0 to 12 percent slopes |
| MaD | Manlius rocky silt loam, 12 to 30 percent slopes |
| MlB | Manlius very rocky silt loam, 0 to 12 percent slopes |
| MlD | Manlius very rocky silt loam, 12 to 30 percent slopes |
| MlF | Manlius very rocky silt loam, 30 to 80 percent slopes |
| MnB2 | Mardin channery silt loam, 2 to 8 percent slopes, moderately eroded |
| MnC2 | Mardin channery silt loam, 8 to 15 percent slopes, moderately eroded |
| MoB | Mardin very stony loam, 0 to 8 percent slopes |
| MoC | Mardin very stony loam, 8 to 25 percent slopes |
| Mr | Middlebury loam |
| MsB2 | Morris channery loam, 3 to 8 percent slopes, moderately eroded |
| MtB | Morris very stony loam, 0 to 8 percent slopes |
| MtC | Morris very stony loam, 8 to 15 percent slopes |
| Mu | Muck |
| NoA | Norwich channery silt loam, 0 to 3 percent slopes |
| NrB | Norwich very stony silt loam, 0 to 8 percent slopes |
| OaB2 | Oquaga channery loam, 3 to 12 percent slopes, moderately eroded |
| OeB | Oquaga extremely stony loam, 0 to 12 percent slopes |
| OeD | Oquaga extremely stony loam, 12 to 30 percent slopes |
| OeF | Oquaga extremely stony loam, 30 to 80 percent slopes |
| OvB | Oquaga very stony loam, 0 to 12 percent slopes |
| OvD | Oquaga very stony loam, 12 to 30 percent slopes |
| Pa | Papakating silt loam |
| Pe | Peat |
| Ps | Peat, shallow |
| Rh | Red Hook loam |
| Rv | Riverwash |
| RwE | Rushtown very shaly silt loam, 25 to 45 percent slopes |
| Sc | Stony and cobbly alluvial land |
| SmD | Stony land, moderately steep |
| SsF | Stony land, steep |
| StB2 | Swartswood channery sandy loam, 3 to 12 percent slopes, moderately eroded |
| StC2 | Swartswood channery sandy loam, 12 to 20 percent slopes, moderately eroded |
| SwB | Swartswood very stony sandy loam, 0 to 12 percent slopes |
| SwD | Swartswood very stony sandy loam, 12 to 30 percent slopes |
| Ta | Tioga loamy fine sand |
| TgA | Tioga loamy fine sand, high bottom, 0 to 3 percent slopes |
| TgB | Tioga loamy fine sand, high bottom, 3 to 12 percent slopes |
| To | Tioga silt loam |
| TsA | Tughill channery silt loam, 0 to 3 percent slopes |
| TtA | Tughill very stony loam, 0 to 3 percent slopes |
| TuB | Tunkhannock gravelly sandy loam, 3 to 12 percent slopes |
| TuC | Tunkhannock gravelly sandy loam, 12 to 20 percent slopes |
| TuD | Tunkhannock gravelly sandy loam, 20 to 30 percent slopes |
| VcA | Volusia channery loam, 0 to 3 percent slopes |
| VcB2 | Volusia channery loam, 3 to 8 percent slopes, moderately eroded |
| VuB | Volusia very stony silt loam, 0 to 8 percent slopes |
| VuD | Volusia very stony silt loam, 8 to 25 percent slopes |
| WuB | Wurtsboro very stony sandy loam, 0 to 8 percent slopes |
| WuC | Wurtsboro very stony sandy loam, 8 to 25 percent slopes |

## CONVENTIONAL SIGNS

### WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail, foot
- Railroad
- Ferry — FY
- Ford — FORD
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings

School

Church

Forest fire or lookout station

Mines and Quarries

Mine dump

Pits, gravel or other

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

### BOUNDARIES

National or state

County

Minor civil division

Reservation

Land grant

Small park, cemetery, airport

### DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches — CANAL

Lakes and ponds
- Perennial — water, w
- Intermittent

Wells, water — flowing

Spring

Marsh or swamp

Wet spot

Alluvial fan

Drainage end

### RELIEF

Escarpments
- Bedrock
- Other

Prominent peak

Depressions (Large, Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

### SOIL SURVEY DATA

Soil boundary and symbol — Dx

Gravel

Stony, very stony

Rock outcrops

Chert fragments

Clay spot

Sand spot

Gumbo or scabby spot

Made land

Severely eroded spot

Blowout, wind erosion

Gully

Soil map constructed 1968 by Cartographic Division, Soil Conservation Service, USDA, from 1959 aerial photographs. Controlled mosaic based on Pennsylvania plane coordinate system, north zone, Lambert conformal conic projection, 1927 North American datum.

For a full description of a mapping unit, read both the description of the mapping unit and the soil series to which the mapping unit belongs. Other information is in the tables as follows:

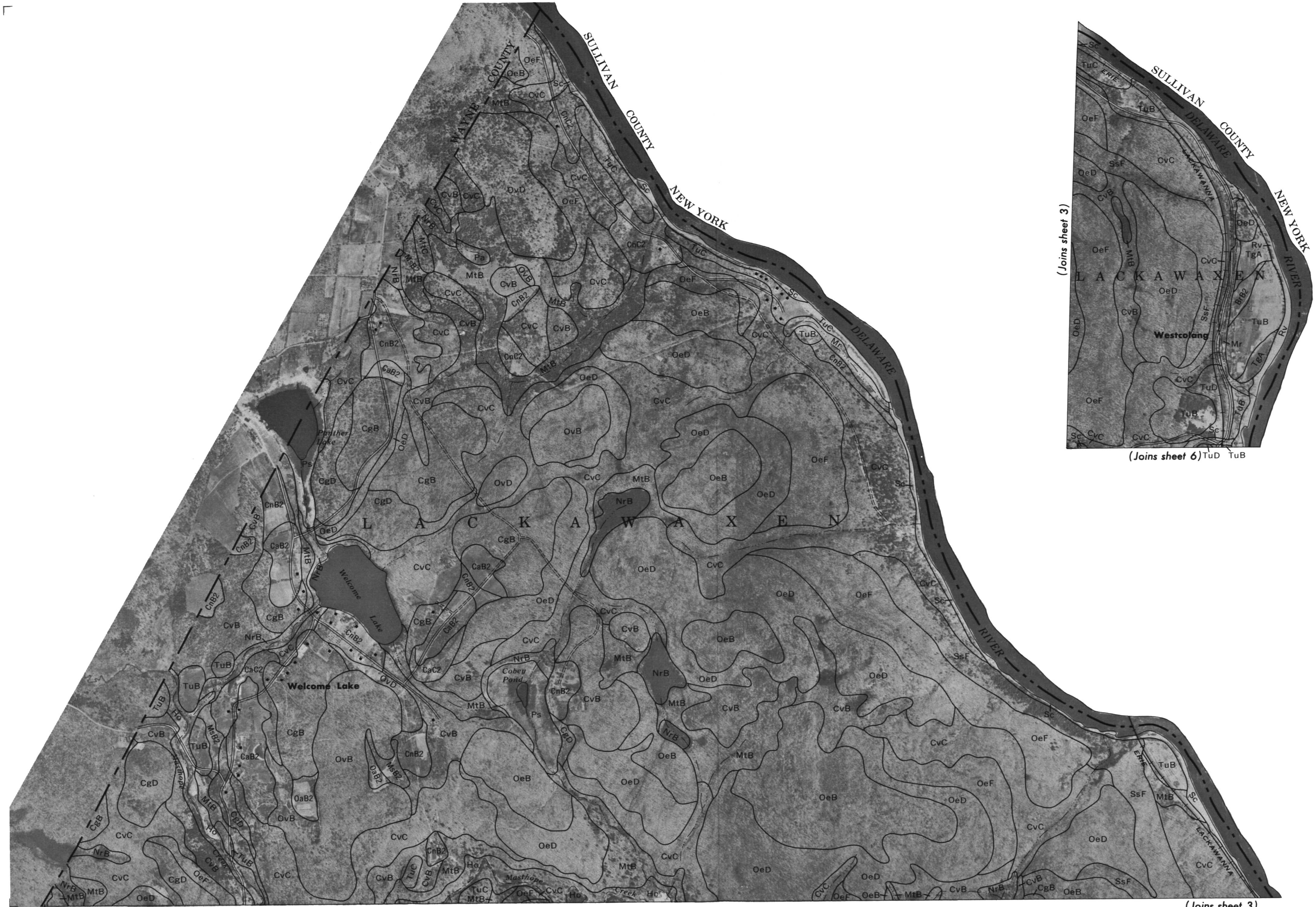
Estimated productivity ratings, table 1, p. 9.
Woodland suitability groups, table 2, p. 12.
Suitability of soils for wildlife, table 3, p. 15.
Engineering uses of soils, tables 4, 5, and 6. pp. 18 through 31.
Community developments, table 7, p. 34.
Recreational developments, table 8, p. 40.
Acreage and extent, table 9, p. 47.

| Map symbol | Soil | Described on page | Capability unit | | Woodland suitability group |
|---|---|---|---|---|---|
| | | | Symbol | Page | Number |
| At | Atherton loam | 48 | IIIw-1 | 7 | 16 |
| BrA | Braceville gravelly loam, 0 to 3 percent slopes | 48 | IIw-1 | 7 | 6 |
| BrB2 | Braceville gravelly loam, 3 to 8 percent slopes, moderately eroded | 48 | IIe-1 | 6 | 6 |
| CaB2 | Cattaraugus channery sandy loam, 3 to 12 percent slopes, moderately eroded | 49 | IIe-1 | 6 | 7 |
| CaC2 | Cattaraugus channery sandy loam, 12 to 20 percent slopes, moderately eroded | 49 | IIIe-1 | 7 | 7 |
| CeB | Cattaraugus extremely stony sandy loam, 0 to 12 percent slopes | 49 | VIIs-1 | 8 | 7 |
| CeD | Cattaraugus extremely stony sandy loam, 12 to 30 percent slopes | 49 | VIIs-1 | 8 | 7 |
| CgB | Cattaraugus very stony sandy loam, 0 to 12 percent slopes | 49 | VIs-1 | 8 | 7 |
| CgD | Cattaraugus very stony sandy loam, 12 to 30 percent slopes | 49 | VIs-1 | 8 | 7 |
| ChB | Chenango cobbly sandy loam, 3 to 12 percent slopes | 50 | IIs-1 | 7 | 9 |
| ChC | Chenango cobbly sandy loam, 12 to 20 percent slopes | 50 | IIIe-1 | 7 | 9 |
| ChD | Chenango cobbly sandy loam, 20 to 30 percent slopes | 51 | IVe-1 | 7 | 9 |
| ClA | Chenango gravelly loam, 0 to 3 percent slopes | 51 | I-1 | 6 | 9 |
| ClB2 | Chenango gravelly loam, 3 to 12 percent slopes, moderately eroded | 51 | IIe-1 | 6 | 9 |
| CmB | Chenango gravelly sandy loam, 0 to 12 percent slopes | 51 | IIs-1 | 7 | 9 |
| CmC | Chenango gravelly sandy loam, 12 to 20 percent slopes | 51 | IIIe-1 | 7 | 9 |
| CmD | Chenango gravelly sandy loam, 20 to 30 percent slopes | 51 | IVe-1 | 7 | 9 |
| CnB2 | Culvers channery loam, 2 to 8 percent slopes, moderately eroded | 52 | IIw-1 | 7 | 6 |
| CnC2 | Culvers channery loam, 8 to 15 percent slopes, moderately eroded | 52 | IIIe-2 | 7 | 6 |
| CuB | Culvers extremely stony loam, 0 to 8 percent slopes | 52 | VIIs-1 | 8 | 6 |
| CuD | Culvers extremely stony loam, 8 to 25 percent slopes | 52 | VIIs-1 | 8 | 6 |
| CvB | Culvers very stony loam, 0 to 8 percent slopes | 52 | VIs-1 | 8 | 6 |
| CvC | Culvers very stony loam, 8 to 25 percent slopes | 52 | VIs-1 | 8 | 6 |
| DeB | Dekalb extremely stony sandy loam, 0 to 12 percent slopes | 53 | VIIs-1 | 8 | 14 |
| DeD | Dekalb extremely stony sandy loam, 12 to 30 percent slopes | 53 | VIIs-1 | 8 | 14 |
| DeF | Dekalb extremely stony sandy loam, 30 to 80 percent slopes | 53 | VIIs-1 | 8 | 15 |
| DsB | Dekalb-Swartswood very stony sandy loams, 0 to 12 percent slopes | 53 | VIs-1 | 8 | 14 |
| DsD | Dekalb-Swartswood very stony sandy loams, 12 to 30 percent slopes | 53 | VIs-1 | 8 | 14 |
| DsF | Dekalb-Swartswood very stony sandy loams, 30 to 80 percent slopes | 53 | VIIs-1 | 8 | 15 |
| Ho | Holly silt loam | 54 | IVw-1 | 8 | 4 |
| MaB | Manlius rocky silt loam, 0 to 12 percent slopes | 54 | IIIe-1 | 7 | 11 |
| MaD | Manlius rocky silt loam, 12 to 30 percent slopes | 54 | VIs-1 | 8 | 11 |
| MlB | Manlius very rocky silt loam, 0 to 12 percent slopes | 55 | VIs-1 | 8 | 11 |
| MlD | Manlius very rocky silt loam, 12 to 30 percent slopes | 55 | VIs-1 | 8 | 11 |
| MlF | Manlius very rocky stlt loam, 30 to 80 percent slopes | 55 | VIIs-1 | 8 | 12 |
| MnB2 | Mardin channery silt loam, 2 to 8 percent slopes, moderately eroded | 55 | IIw-1 | 7 | 6 |
| MnC2 | Mardin channery silt loam, 8 to 15 percent slopes, moderately eroded | 56 | IIIe-2 | 7 | 6 |
| MoB | Mardin very stony loam, 0 to 8 percent slopes | 56 | VIs-1 | 8 | 6 |
| MoC | Mardin very stony loam, 8 to 25 percent slopes | 56 | VIs-1 | 8 | 6 |
| Mr | Middlebury loam | 56 | IIw-1 | 7 | 3 |
| MsB2 | Morris channery loam, 3 to 8 percent slopes, moderately eroded | 57 | IIIw-1 | 7 | 13 |
| MtB | Morris very stony loam, 0 to 8 percent slopes | 57 | VIIs-1 | 8 | 13 |
| MtC | Morris very stony loam, 8 to 15 percent slopes | 57 | VIIs-1 | 8 | 13 |
| Mu | Muck | 57 | VIIw-1 | 8 | 17 |
| NoA | Norwich channery silt loam, 0 to 3 percent slopes | 58 | IVw-1 | 8 | 16 |
| NrB | Norwich very stony silt loam, 0 to 8 percent slopes | 58 | VIIs-1 | 8 | 16 |
| OaB2 | Oquaga channery loam, 3 to 12 percent slopes, moderately eroded | 59 | IIIe-1 | 7 | 11 |
| OeB | Oquaga extremely stony loam, 0 to 12 percent slopes | 59 | VIIs-1 | 8 | 11 |
| OeD | Oquaga extremely stony loam, 12 to 30 percent slopes | 59 | VIIs-1 | 8 | 11 |
| OeF | Oquaga extremely stony loam, 30 to 80 percent slopes | 59 | VIIs-1 | 8 | 12 |
| OvB | Oquaga very stony loam, 0 to 12 percent slopes | 59 | VIs-1 | 8 | 11 |
| OvD | Oquaga very stony loam, 12 to 30 percent slopes | 59 | VIs-1 | 8 | 11 |
| Pa | Papakating silt loam | 60 | VIw-1 | 8 | 5 |
| Pe | Peat | 60 | VIIw-1 | 8 | 17 |
| Ps | Peat, shallow | 60 | VIIw-1 | 8 | 17 |
| Rh | Red Hook loam | 61 | IIIw-1 | 7 | 8 |
| Rv | Riverwash | 61 | VIIIs-1 | 8 | 17 |
| RwE | Rushtown very shaly silt loam, 25 to 45 percent slopes | 61 | VIIe-1 | 8 | 10 |
| Sc | Stony and cobbly alluvial land | 61 | VIs-2 | 8 | 17 |
| SmD | Stony land, moderately steep | 62 | VIIIs-1 | 8 | 17 |
| SsF | Stony land, steep | 62 | VIIIs-1 | 8 | 17 |
| StB2 | Swartswood channery sandy loam, 3 to 12 percent slopes, moderately eroded | 63 | IIe-1 | 6 | 9 |
| StC2 | Swartswood channery sandy loam, 12 to 20 percent slopes, moderately eroded | 63 | IIIe-1 | 7 | 9 |
| SwB | Swartswood very stony sandy loam, 0 to 12 percent slopes | 63 | VIs-1 | 8 | 9 |
| SwD | Swartswood very stony sandy loam, 12 to 30 percent slopes | 63 | VIs-1 | 8 | 9 |
| Ta | Tioga loamy fine sand | 65 | IIs-1 | 7 | 2 |
| TgA | Tioga loamy fine sand, high bottom, 0 to 3 percent slopes | 65 | IIs-1 | 7 | 2 |
| TgB | Tioga loamy fine sand, high bottom, 3 to 12 percent slopes | 65 | IIs-1 | 7 | 2 |
| To | Tioga silt loam | 65 | I-1 | 6 | 1 |
| TsA | Tughill channery silt loam, 0 to 3 percent slopes | 66 | IVw-1 | 8 | 16 |
| TtA | Tughill very stony loam, 0 to 3 percent slopes | 66 | VIIs-2 | 8 | 16 |
| TuB | Tunkhannock gravelly sandy loam, 3 to 12 percent slopes | 67 | IIs-1 | 7 | 9 |
| TuC | Tunkhannock gravelly sandy loam, 12 to 20 percent slopes | 67 | IIIe-1 | 7 | 9 |
| TuD | Tunkhannock gravelly sandy loam, 20 to 30 percent slopes | 67 | IVe-1 | 7 | 9 |
| VcA | Volusia channery loam, 0 to 3 percent slopes | 68 | IIIw-1 | 7 | 13 |
| VcB2 | Volusia channery loam, 3 to 8 percent slopes, moderately eroded | 68 | IIIw-1 | 7 | 13 |
| VuB | Volusia very stony silt loam, 0 to 8 percent slopes | 68 | VIIs-1 | 8 | 13 |
| VuD | Volusia very stony silt loam, 8 to 25 percent slopes | 68 | VIIs-1 | 8 | 13 |
| WuB | Wurtsboro very stony sandy loam, 0 to 8 percent slopes | 69 | VIs-1 | 8 | 9 |
| WuC | Wurtsboro very stony sandy loam, 8 to 25 percent slopes | 69 | VIs-1 | 8 | 9 |

296-311 O - 69 (Face maps)

1

N

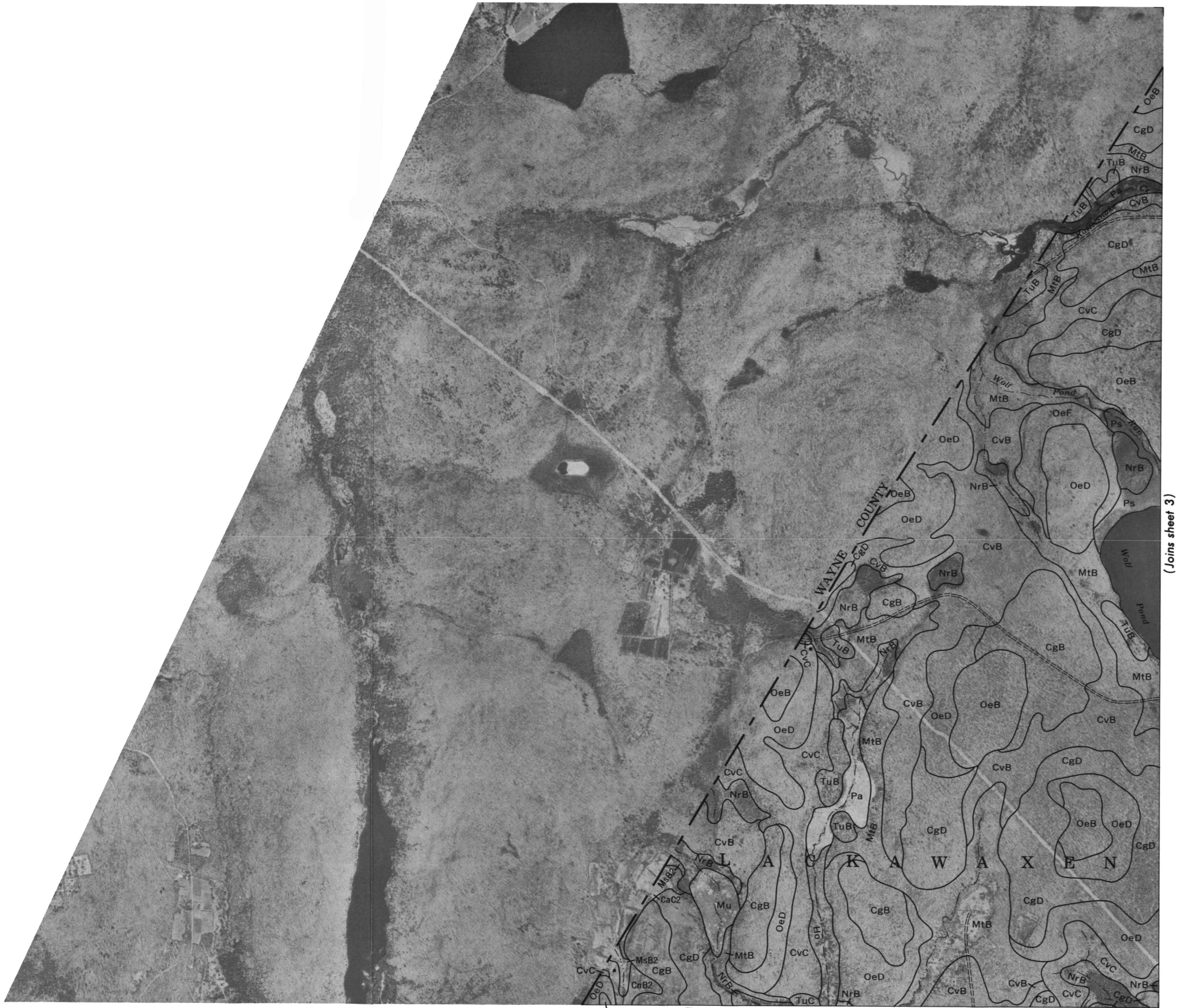



0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 1

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

N




(Joins sheet 3)

0 ½ 1 Mile

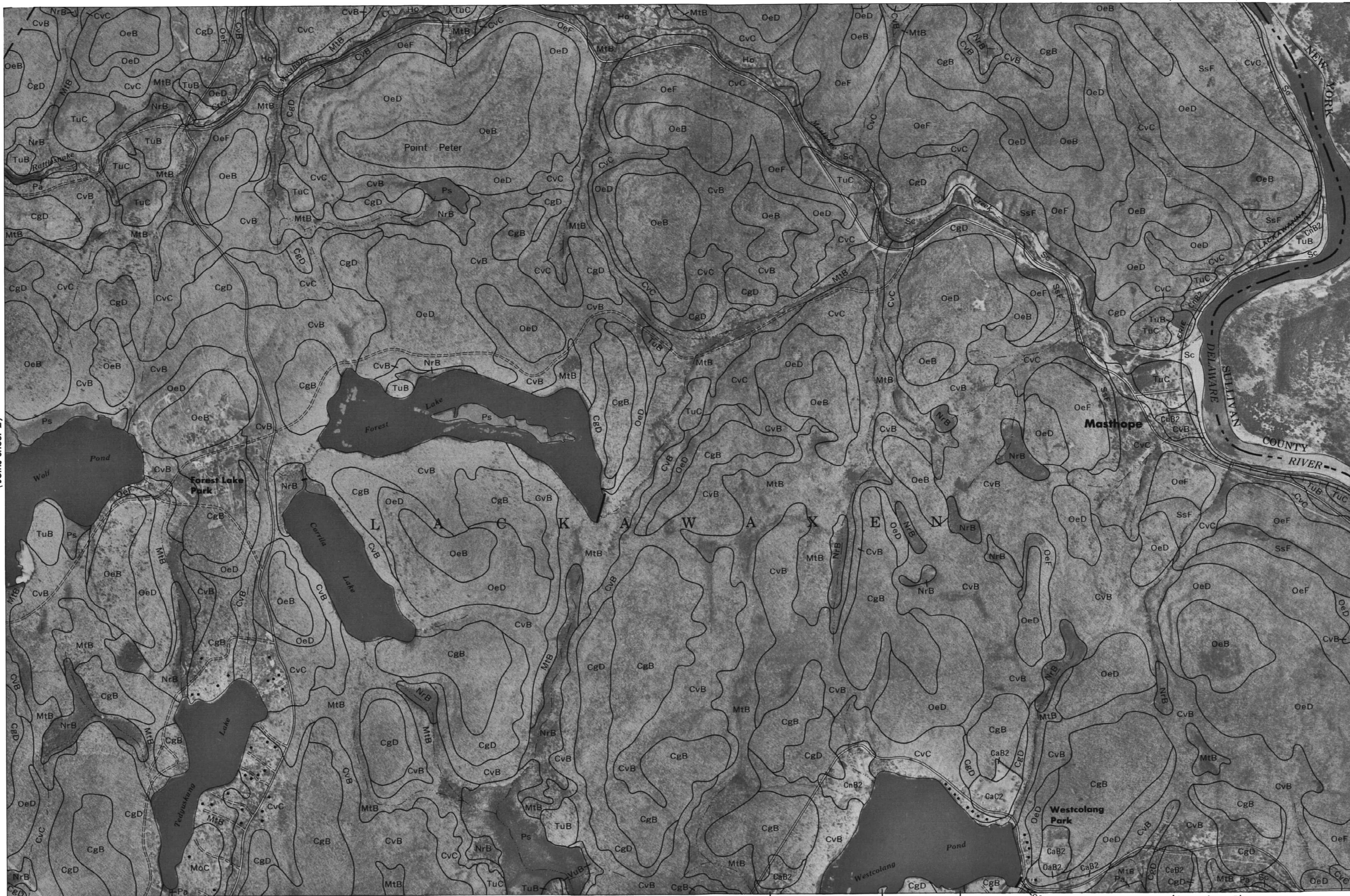
Scale 1:20 000

0 5 000 Feet

(Joins sheet 4)

PIKE COUNTY, PENNSYLVANIA SHEET NO. 2

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.




0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 3

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

PIKE COUNTY, PENNSYLVANIA — SHEET NUMBER 4

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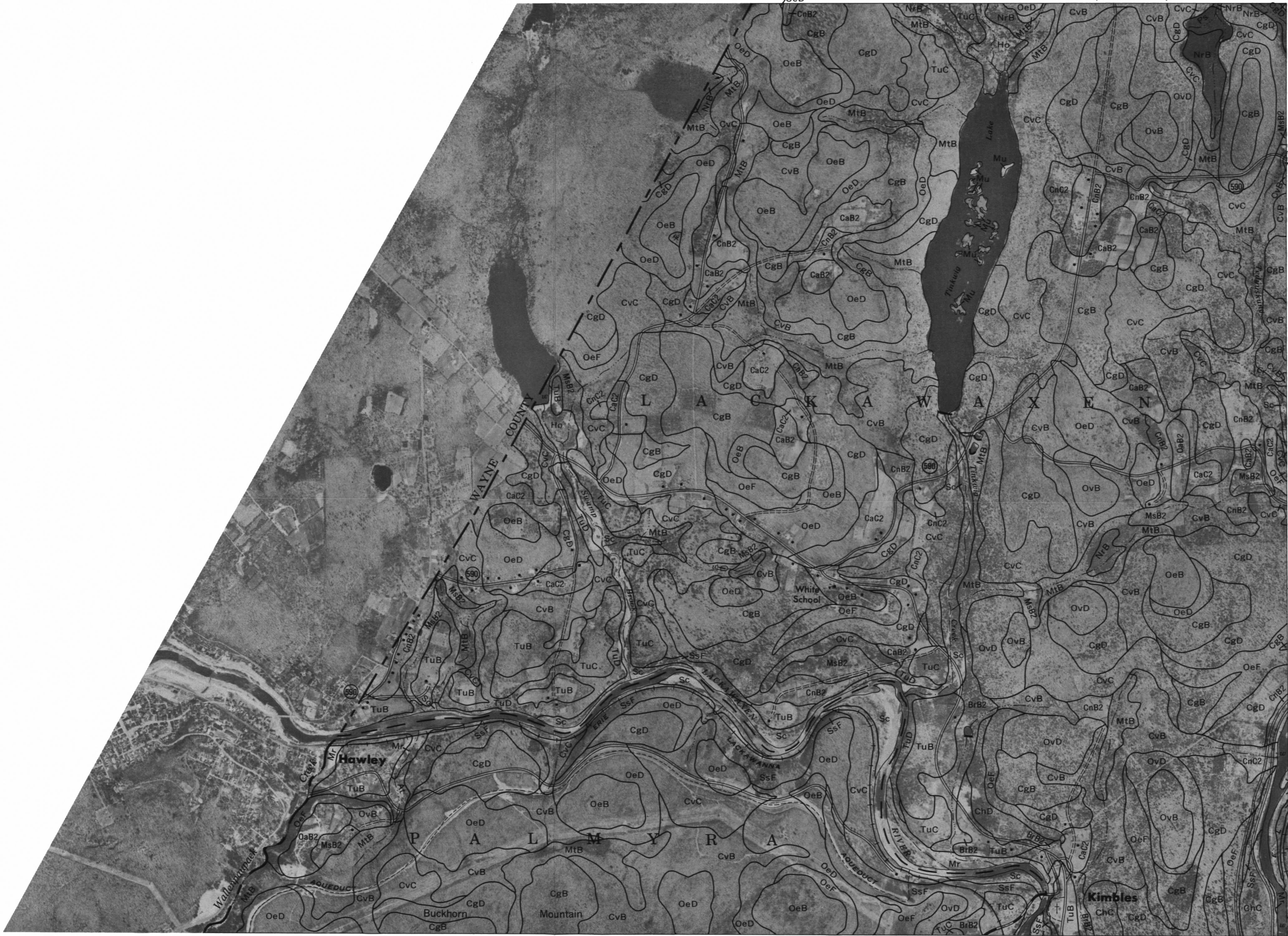



(Joins sheet 5)

(Joins sheet 7)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 4

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

5


0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 5

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

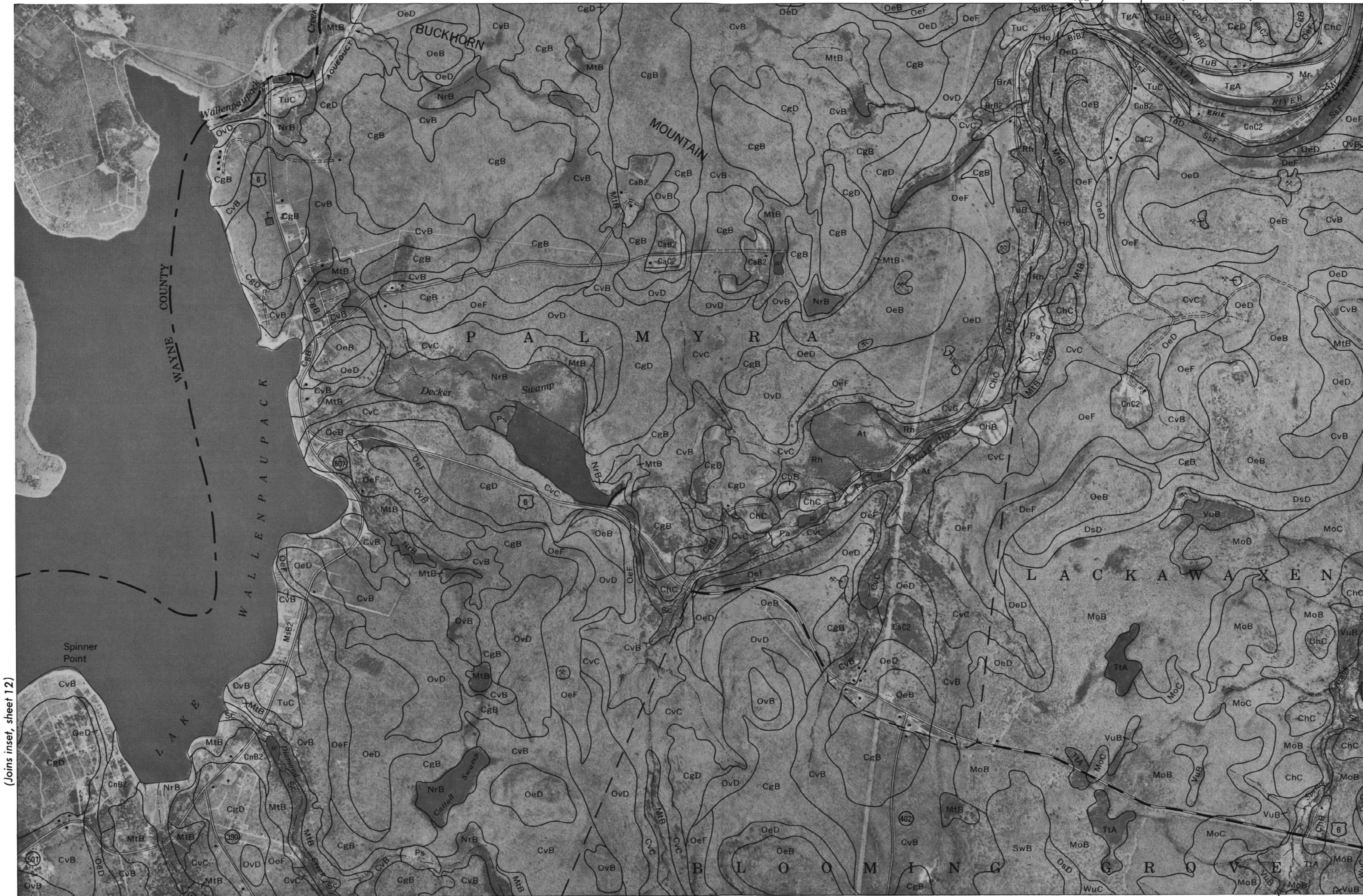

PIKE COUNTY, PENNSYLVANIA SHEET NO. 6

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

PIKE COUNTY, PENNSYLVANIA SHEET NO. 7

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

(Joins sheet 4)




(Joins sheet 8)

(Joins inset, sheet 12)

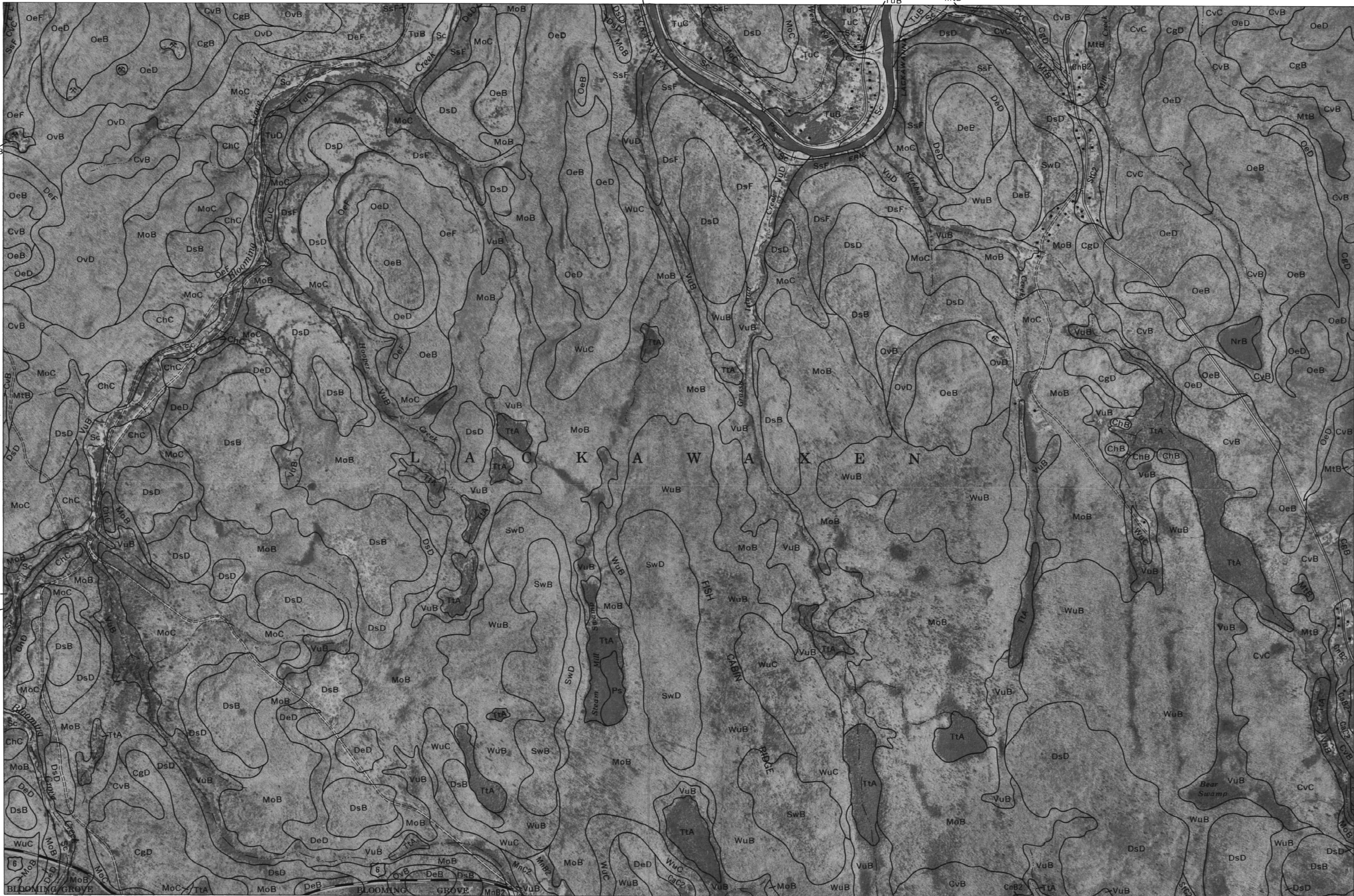
(Joins sheet 13)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA — SHEET NUMBER 8




(Joins sheet 5)
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 14)

0 ½ 1 Mile
Scale 1:20 000
0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 8

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

9

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

PIKE COUNTY, PENNSYLVANIA SHEET NO. 9


0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

10

(Joins inset, sheet 6)

(Joins sheet 9)


(Joins sheet 11)

(Joins sheet 16)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 10

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

PIKE COUNTY, PENNSYLVANIA SHEET NO. 11

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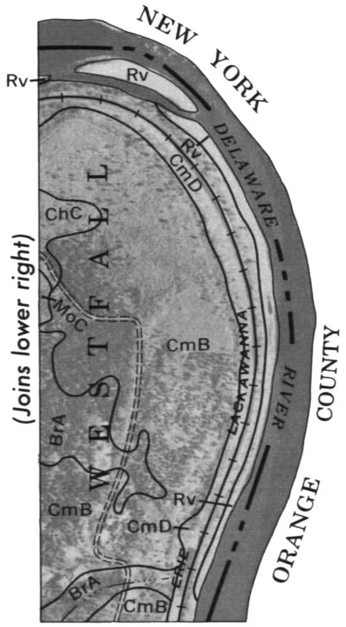


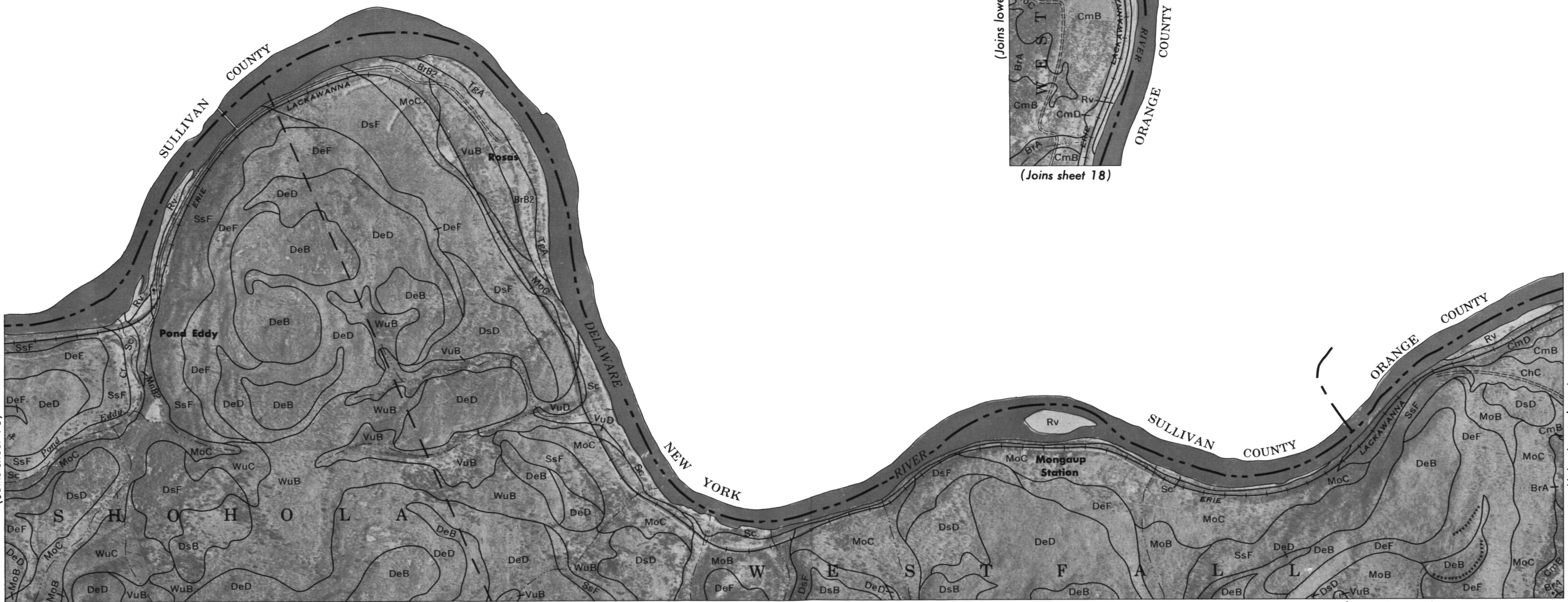


0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

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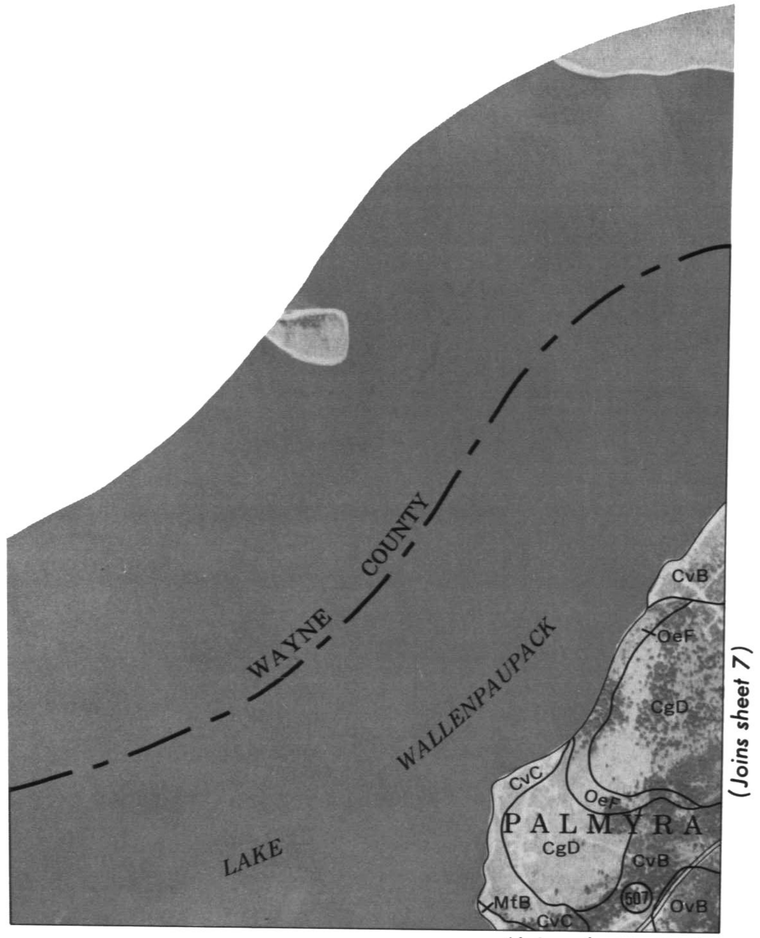


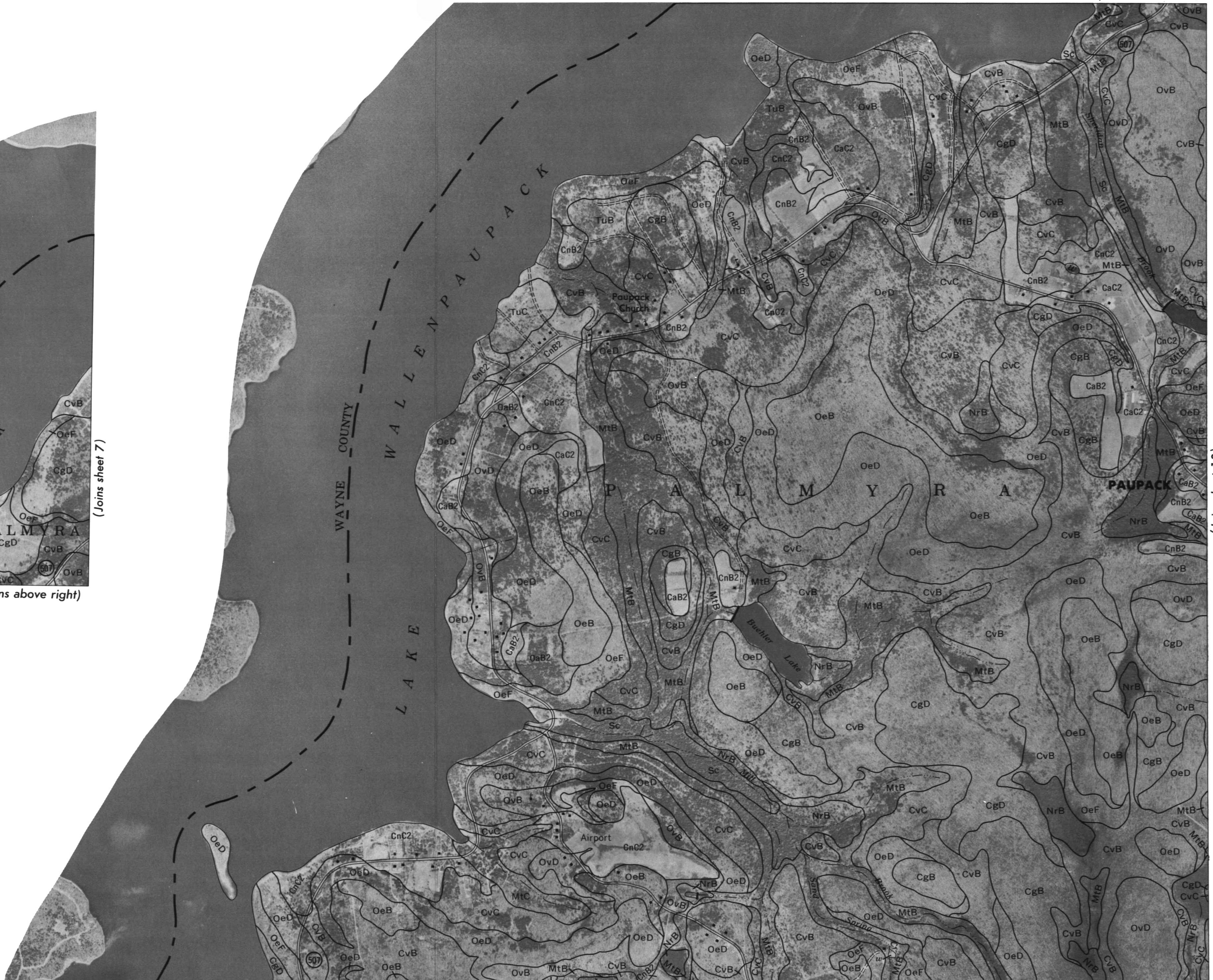


0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 12

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

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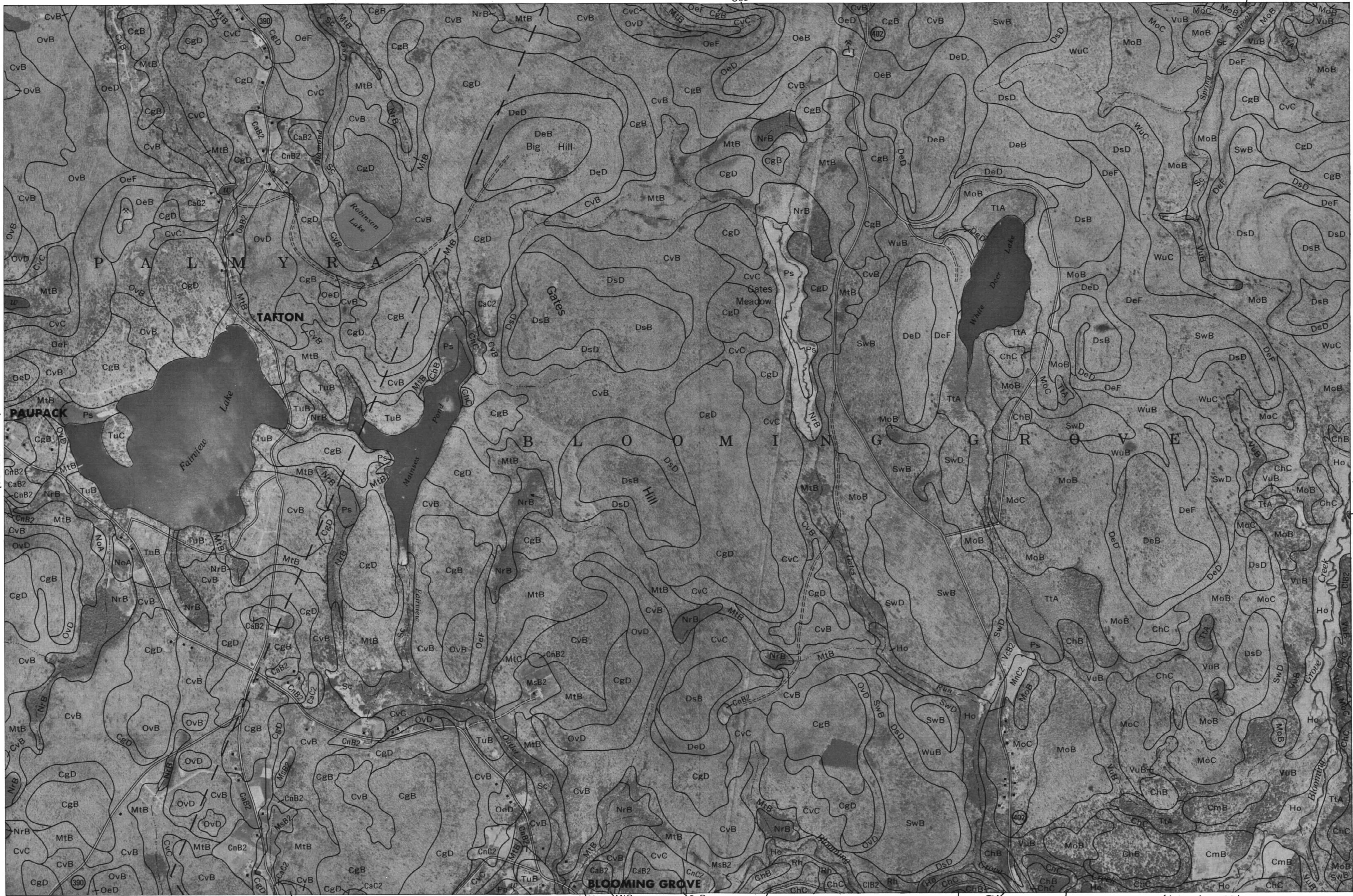
(Joins sheet 12)




(Joins sheet 14)

(Joins sheet 21)

Scale 1:20 000

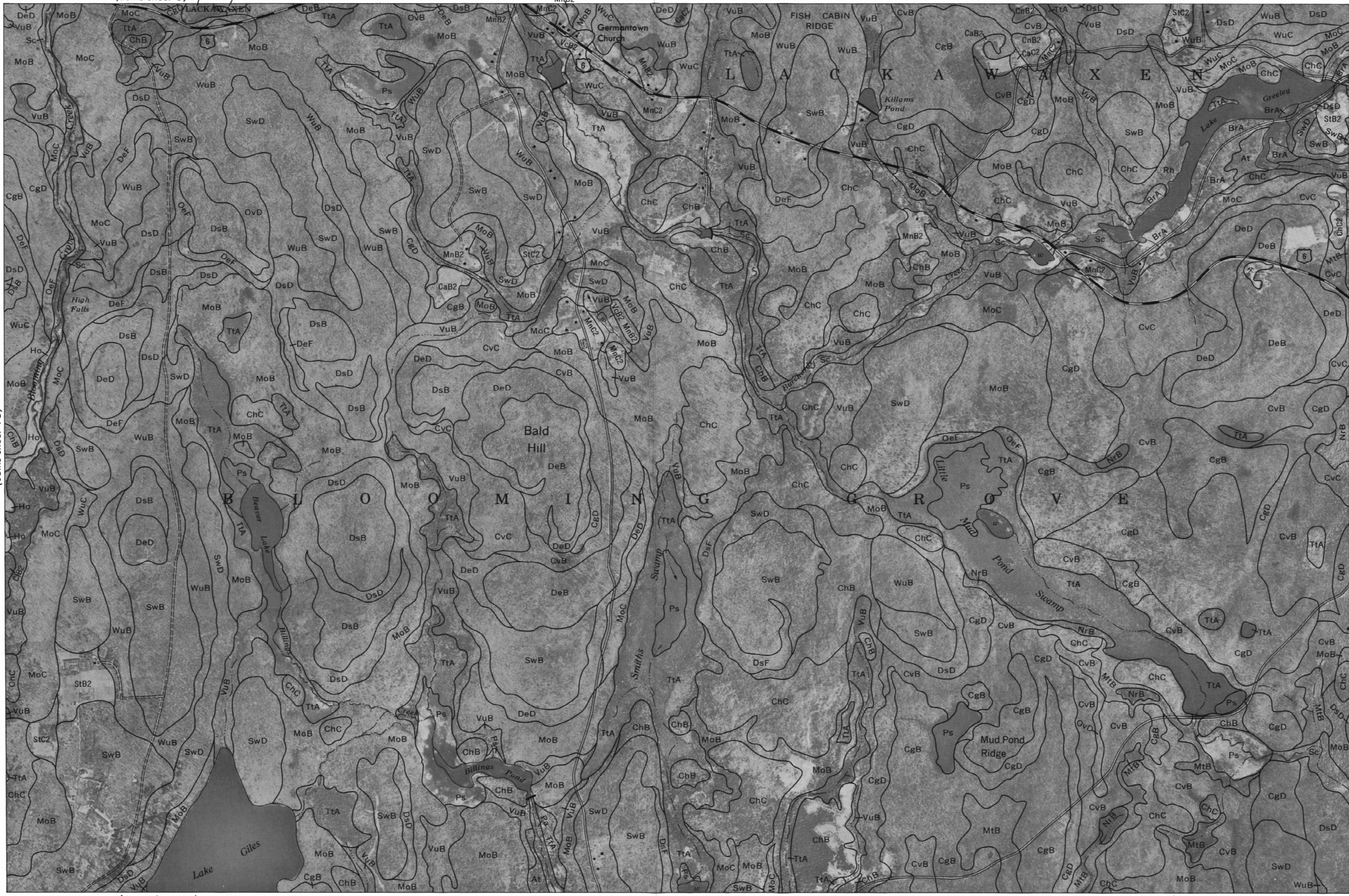
0 ½ 1 Mile

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 13

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

(Joins sheet 8)




(Joins sheet 13)

(Joins sheet 15)

(Joins sheet 22)

0 ½ 1 Mile

Scale 1:20 000

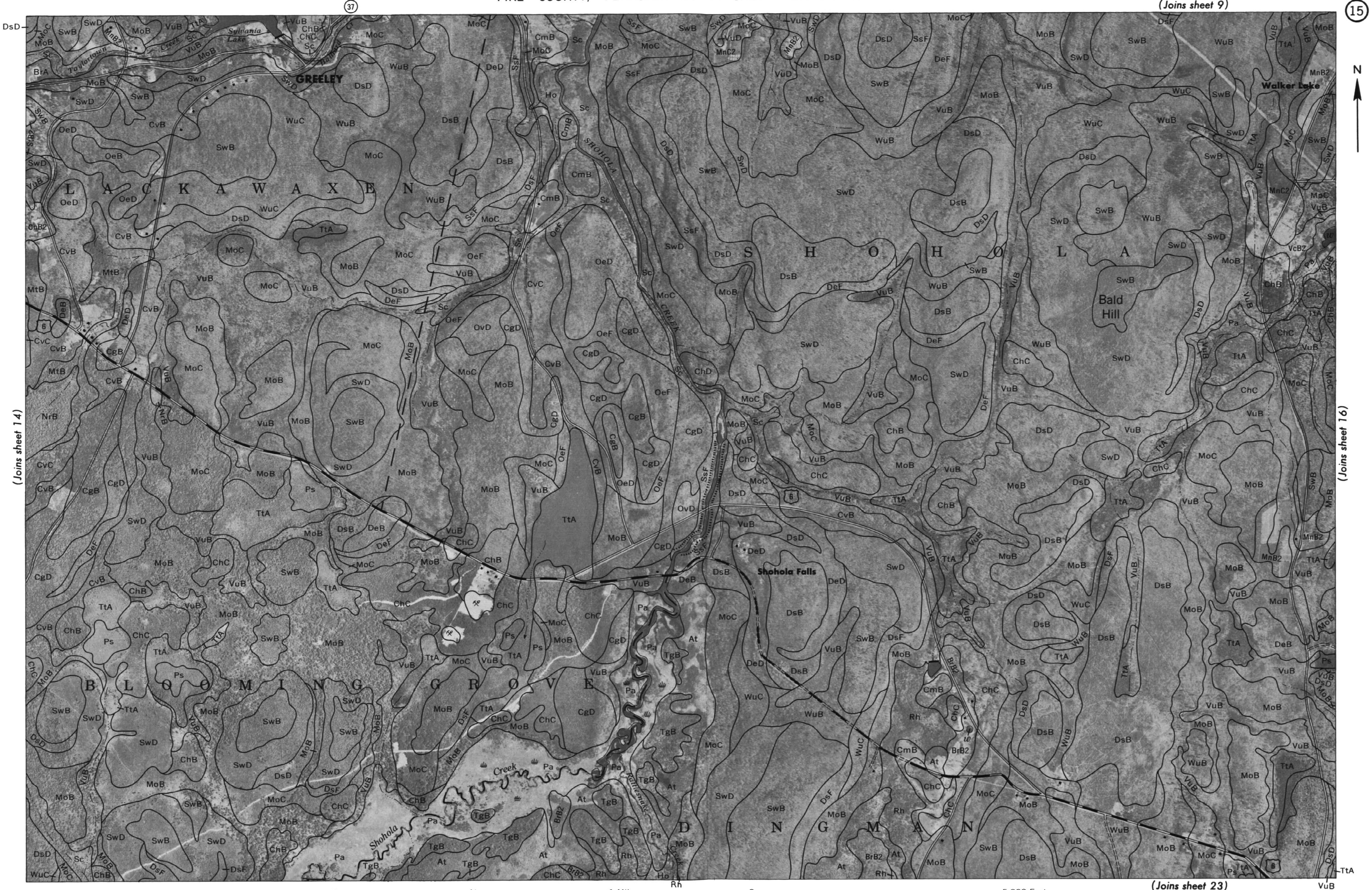
0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 14

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

*(Joins sheet 9)*

15




*(Joins sheet 14)*

*(Joins sheet 16)*

*(Joins sheet 23)*

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 15

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

PIKE COUNTY, PENNSYLVANIA — SHEET NUMBER 16

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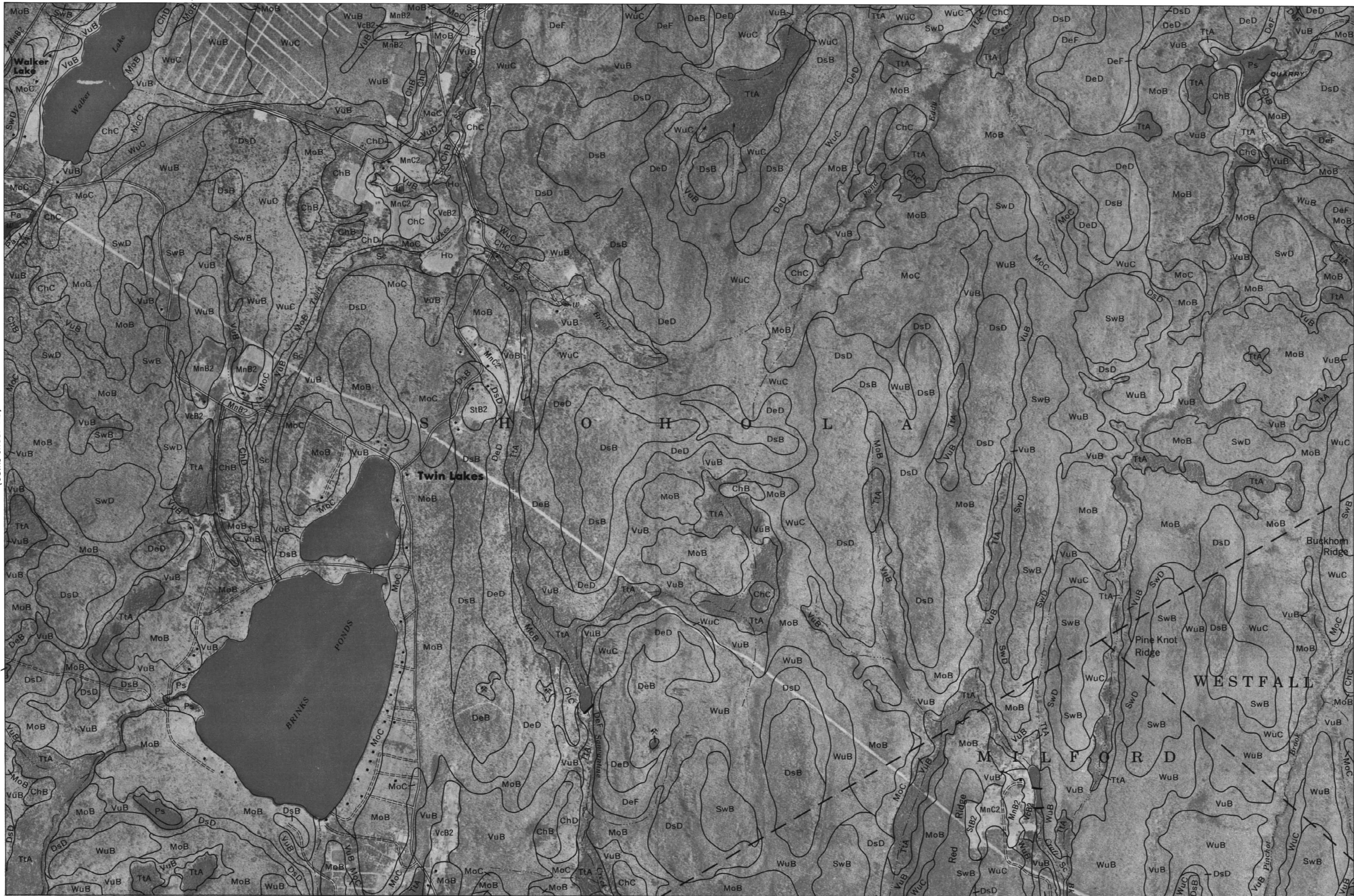



(Joins sheet 17)

(Joins sheet 24)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 16

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.


0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

(18) (Joins inset, sheet 11)


(Joins sheet 17)

(Joins sheet 26)

MlD MlF SsF Sc

0 ½ 1 Mile

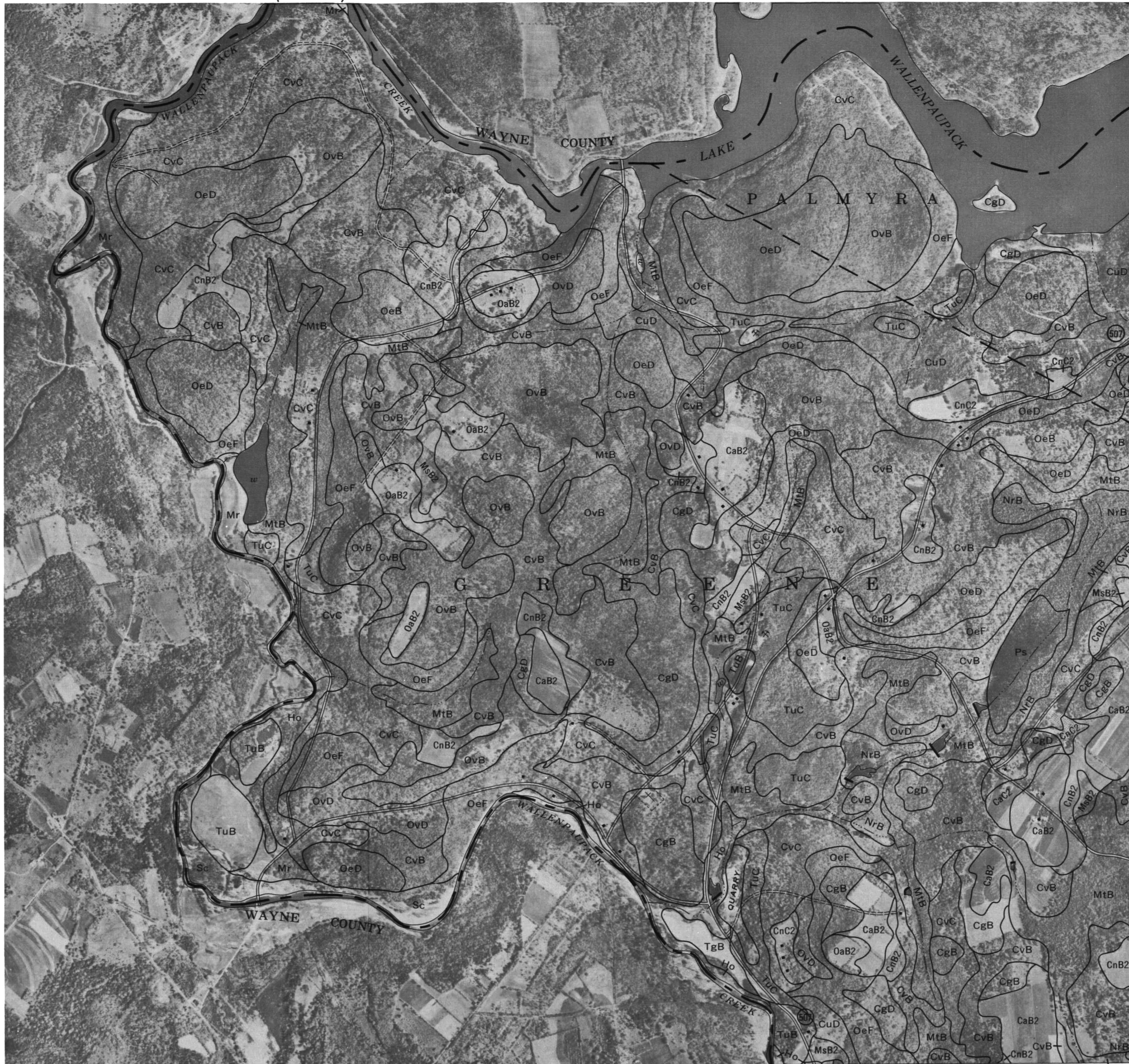
Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 18

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

(Joins inset)

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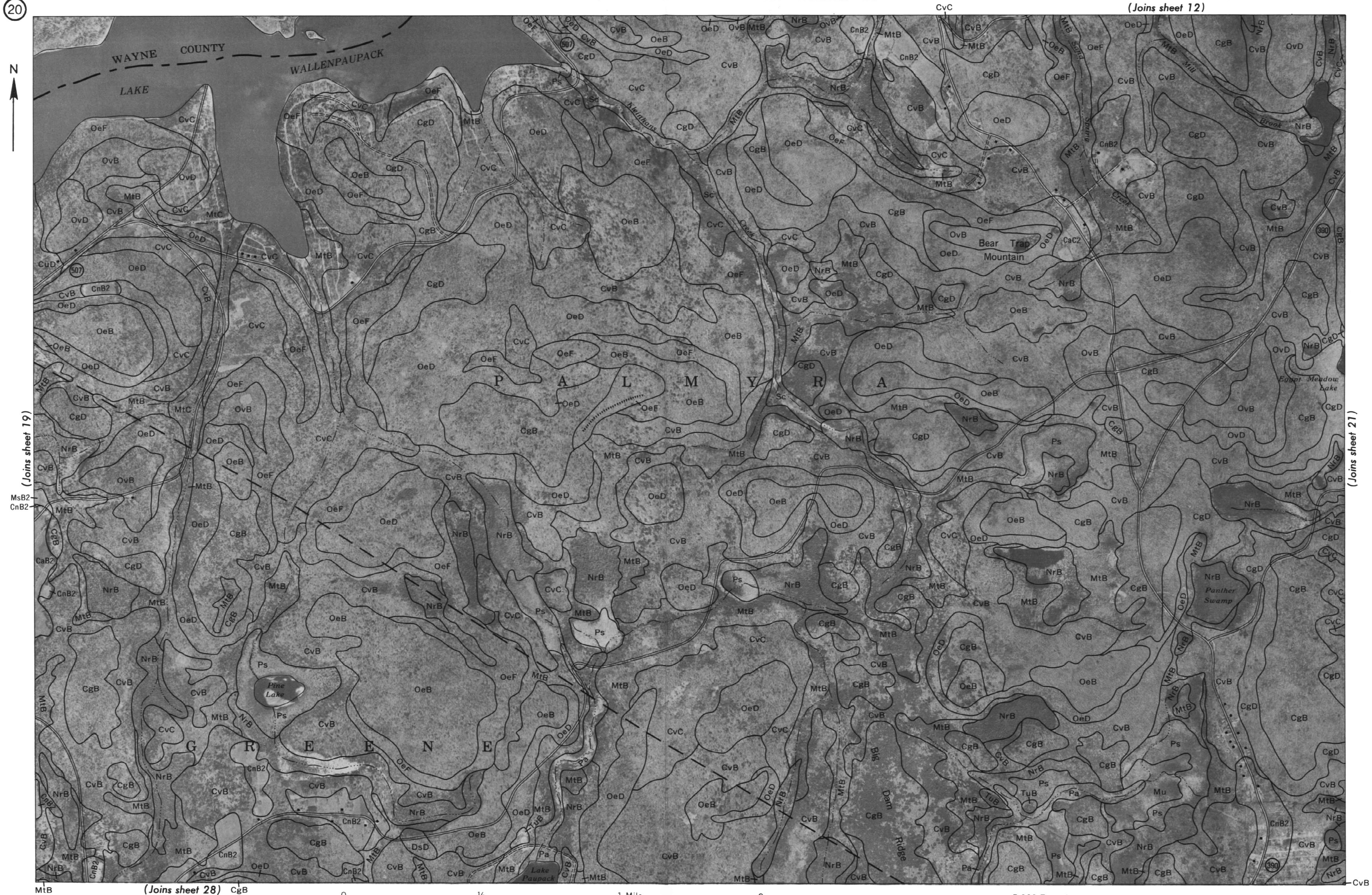
(Joins above)

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 19

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

PIKE COUNTY, PENNSYLVANIA — SHEET NUMBER 20




0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 20

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

(Joins sheet 13)


(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 29)

Scale 1:20 000

0 ½ 1 Mile

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 21

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

PIKE COUNTY, PENNSYLVANIA — SHEET NUMBER 22

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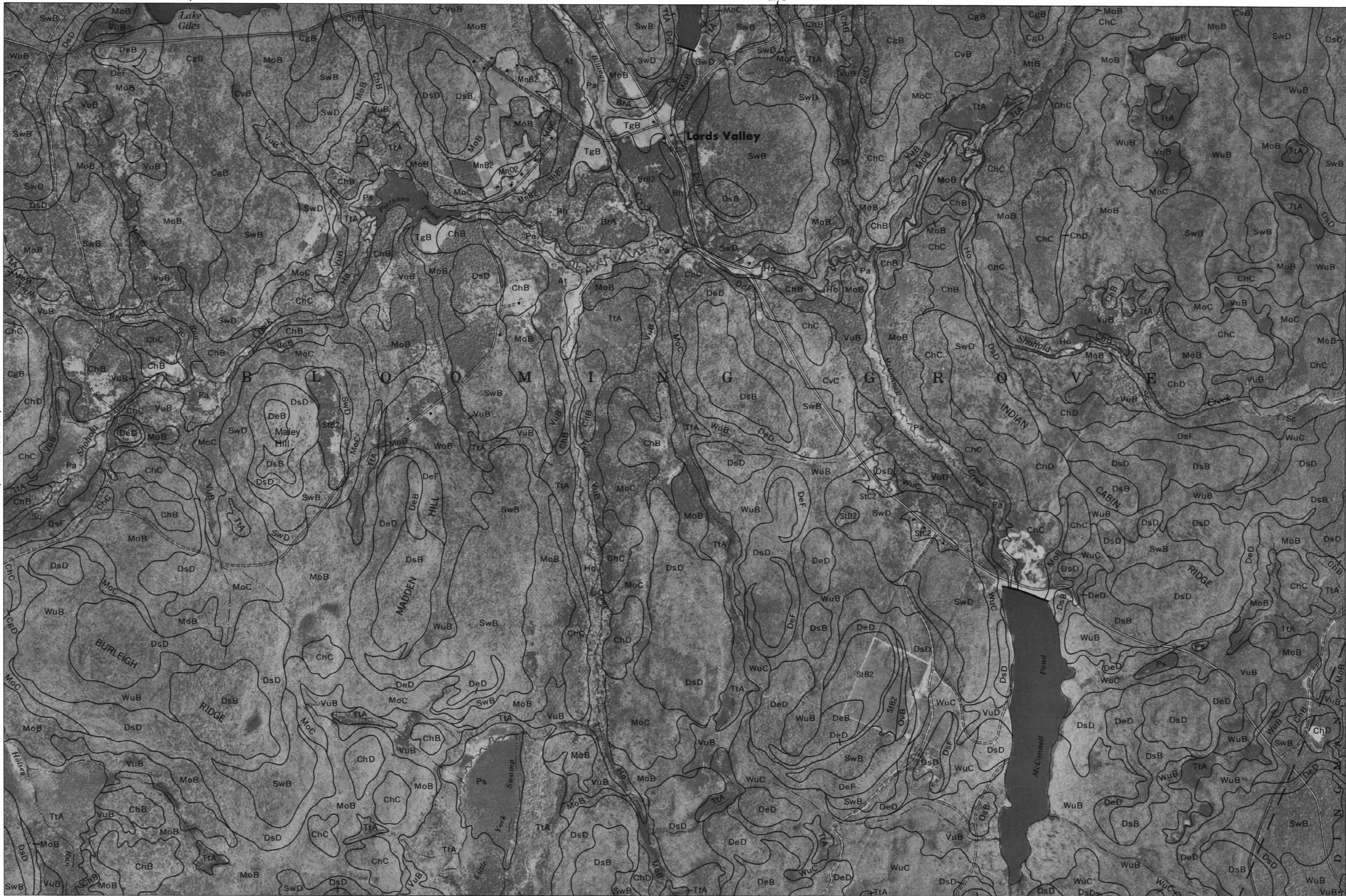


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(Joins sheet 30)

0 ½ 1 Mile

Scale 1:20 000

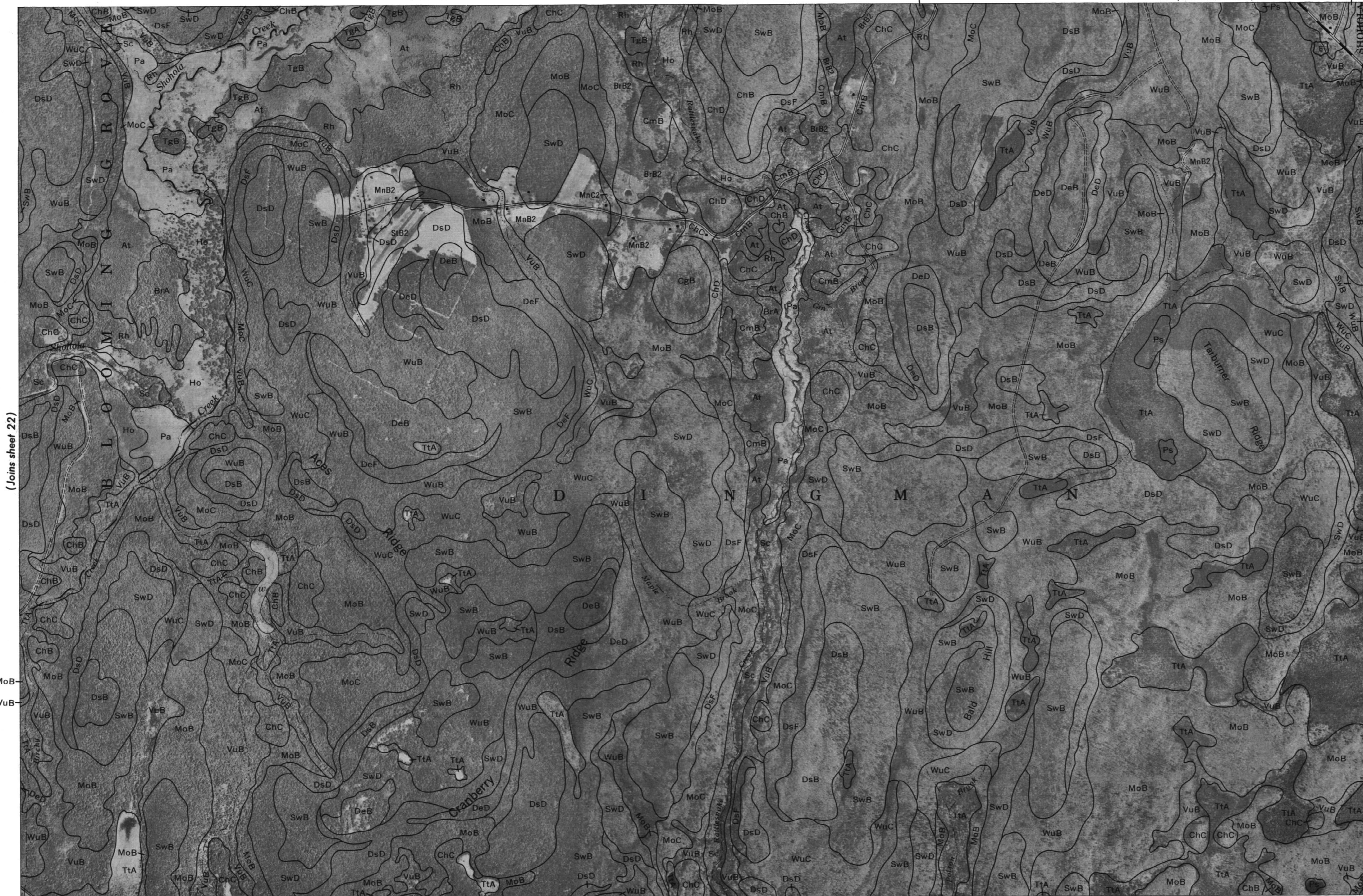
0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 22

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

23

(Joins sheet 15)

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(Joins sheet 24)

(Joins sheet 31)

Scale 1:20 000

0 ½ 1 Mile

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 23

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

(Joins sheet 16)

(Joins sheet 23)


(Joins sheet 25)

(Joins sheet 32)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

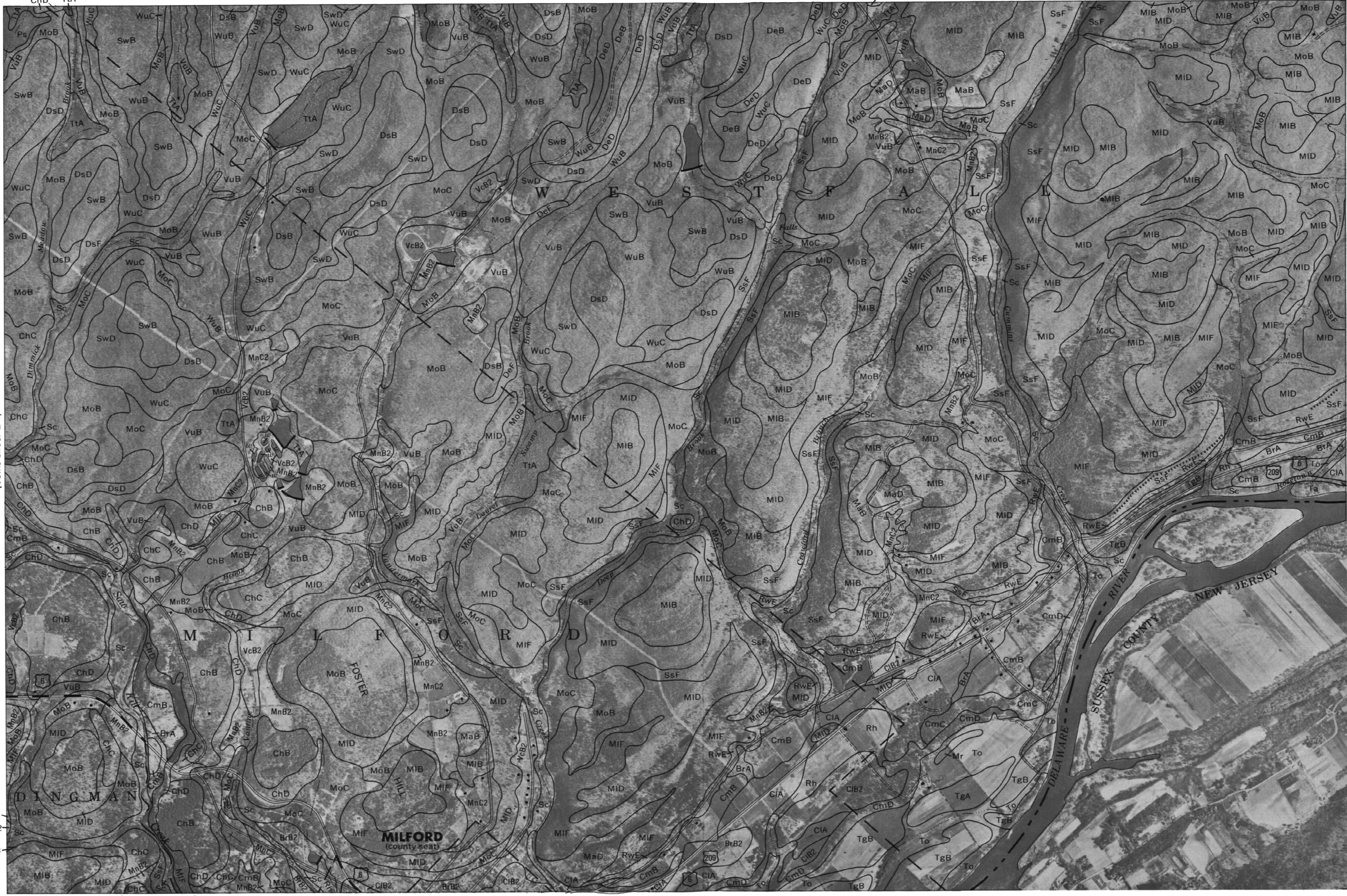
PIKE COUNTY, PENNSYLVANIA SHEET NO. 24

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

25

(Joins sheet 17)

(Joins sheet 24)

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0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 25

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.


0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 26

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

27

(Joins sheet 19)


(Joins sheet 28)

(Joins sheet 34)

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

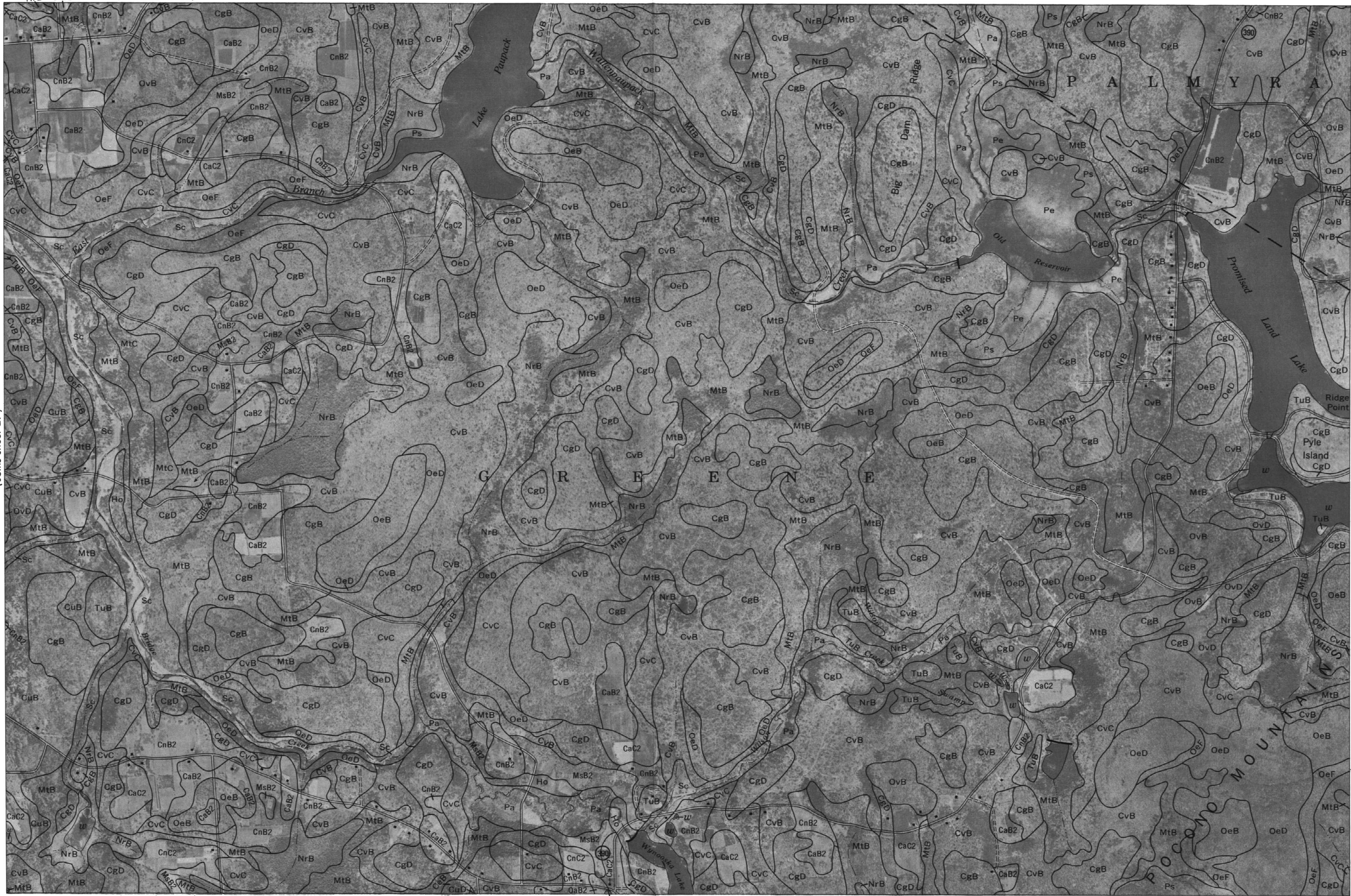
PIKE COUNTY, PENNSYLVANIA SHEET NO. 27

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

28

(Joins sheet 20)

(Joins sheet 27)

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0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 28

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

29

(Joins sheet 21)


(Joins sheet 28)

(Joins sheet 30)

(Joins sheet 36)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

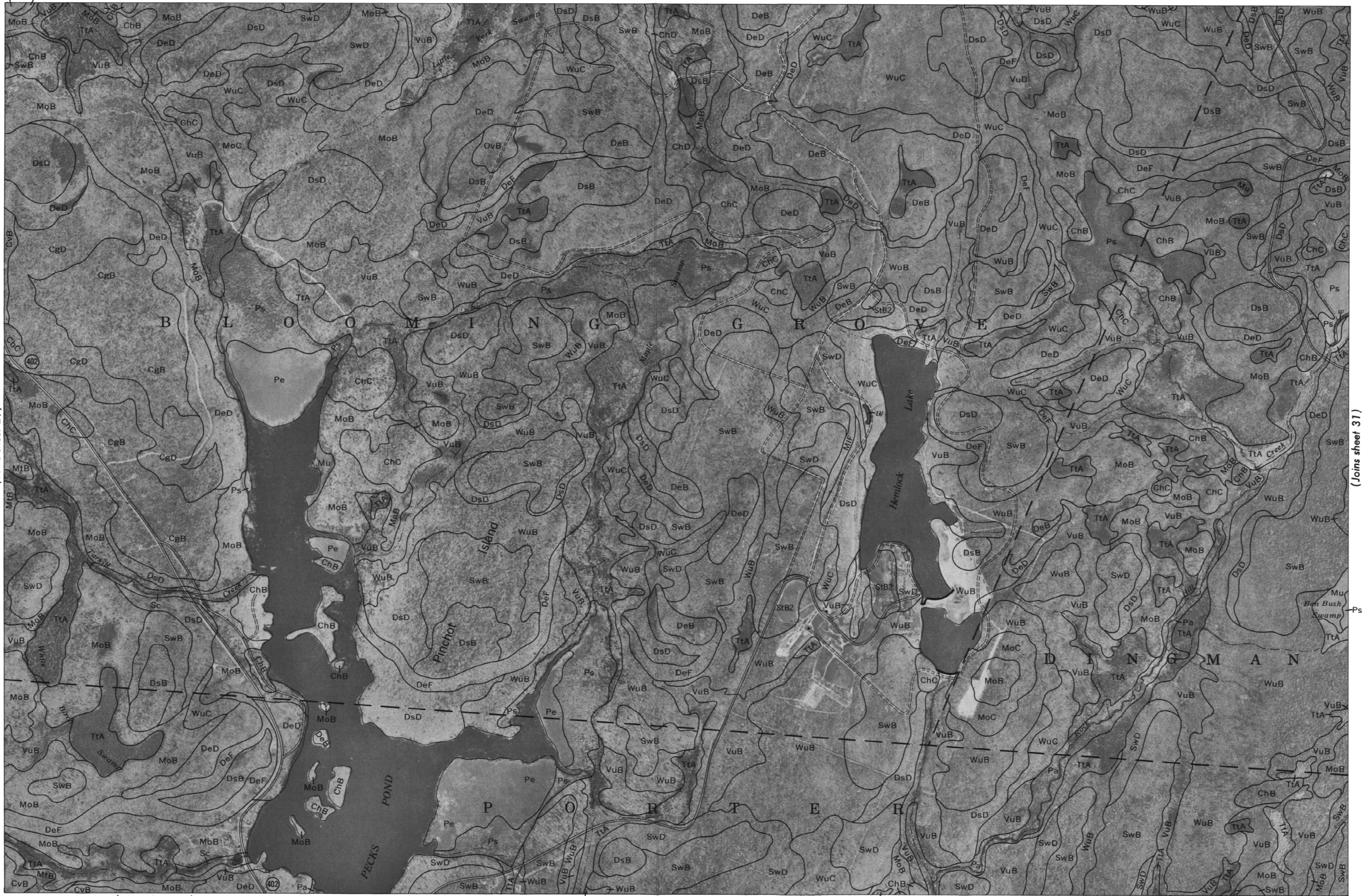
PIKE COUNTY, PENNSYLVANIA SHEET NO. 29

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

30

(Joins sheet 22)

(Joins sheet 29)

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0 ½ 1 Mile

Scale 1:20 000

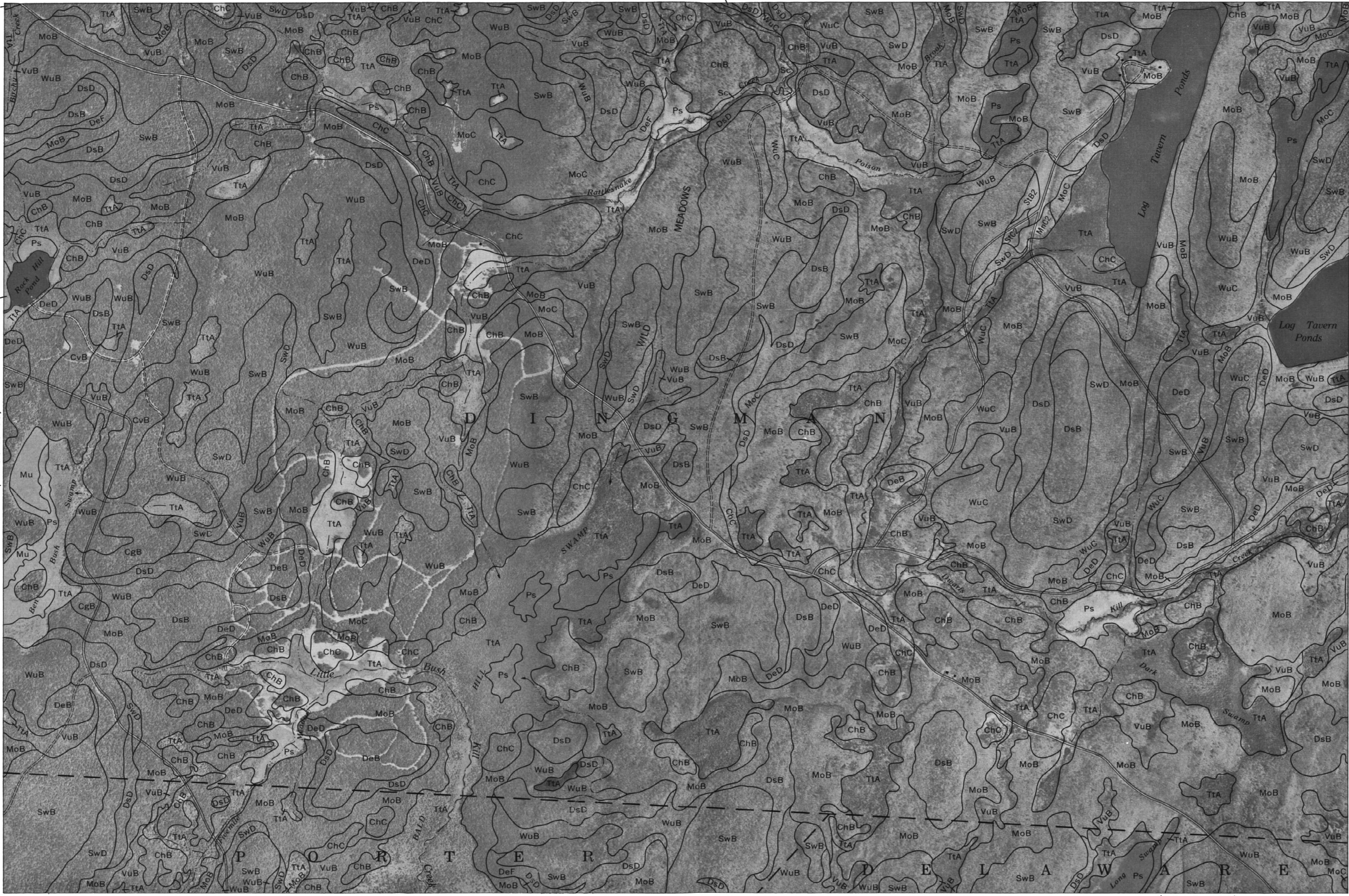
0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 30

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

31

(Joins sheet 23)




(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 38)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

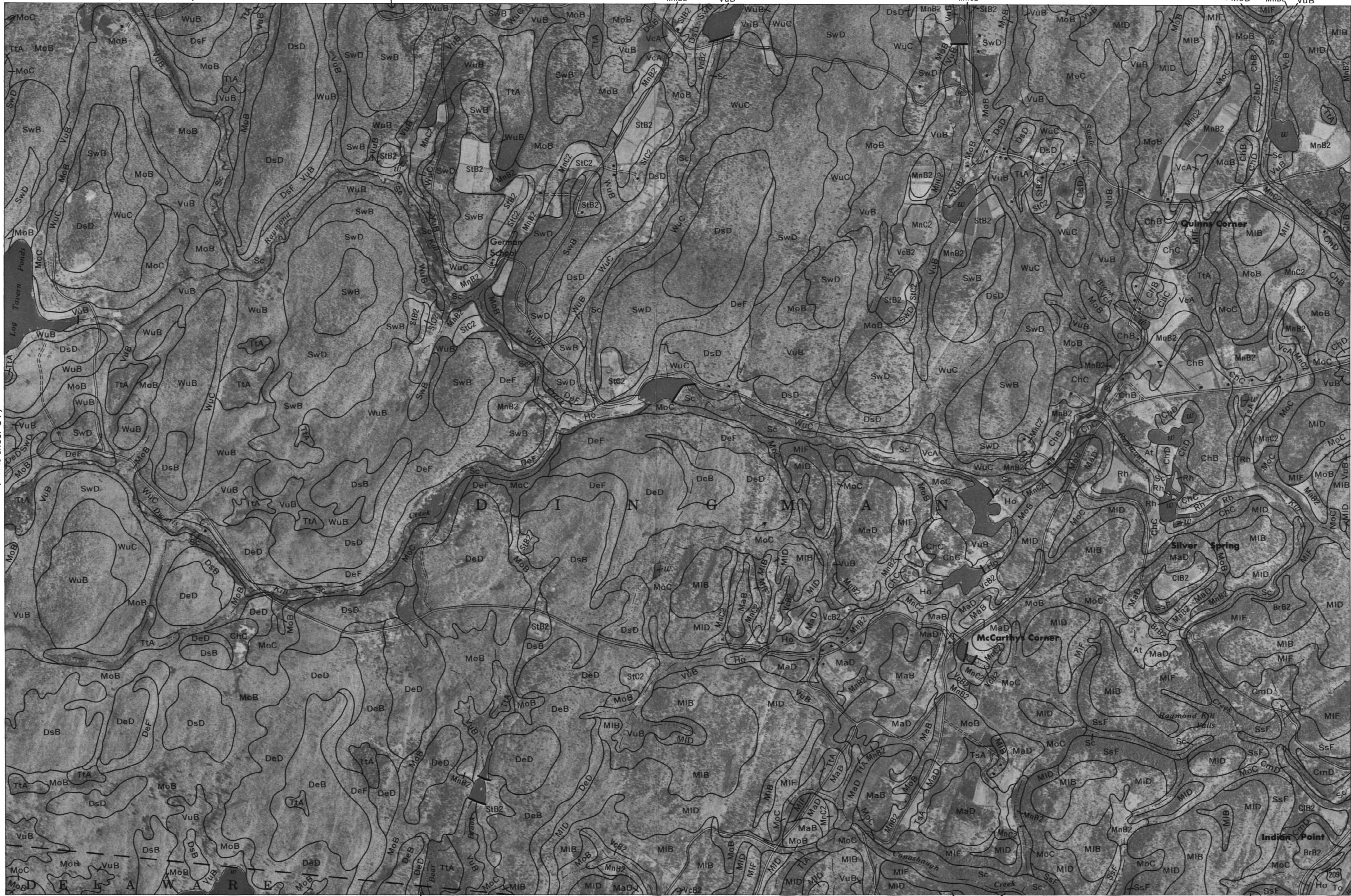
PIKE COUNTY, PENNSYLVANIA SHEET NO. 31

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

32

(Joins sheet 24)

(Joins sheet 31)




(Joins sheet 33)

(Joins sheet 39)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 32

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

33

(Joins sheet 25)

(Joins sheet 32)


N

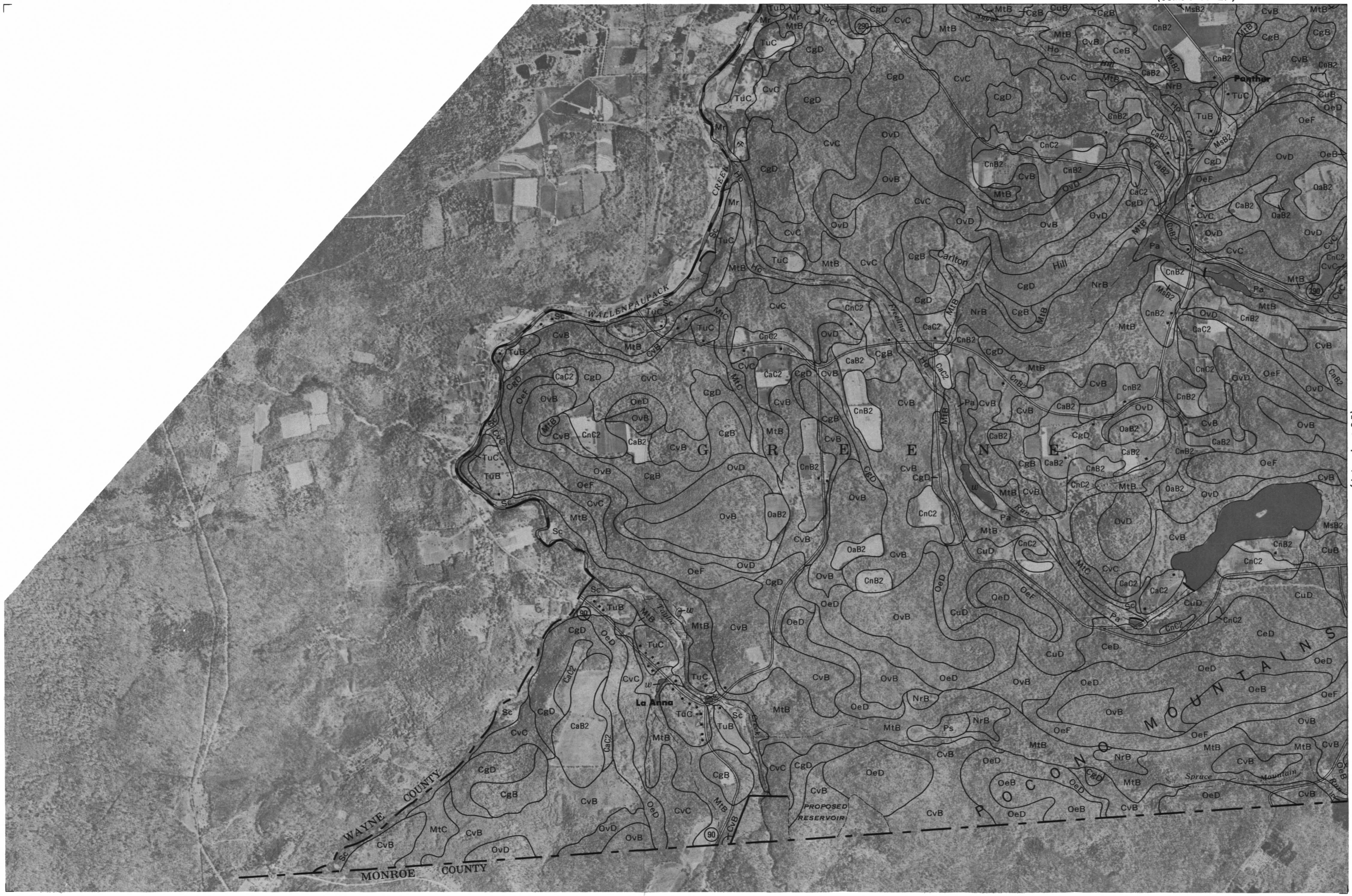
0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

PIKE COUNTY, PENNSYLVANIA — SHEET NUMBER 34

N

*(Joins sheet 27)*



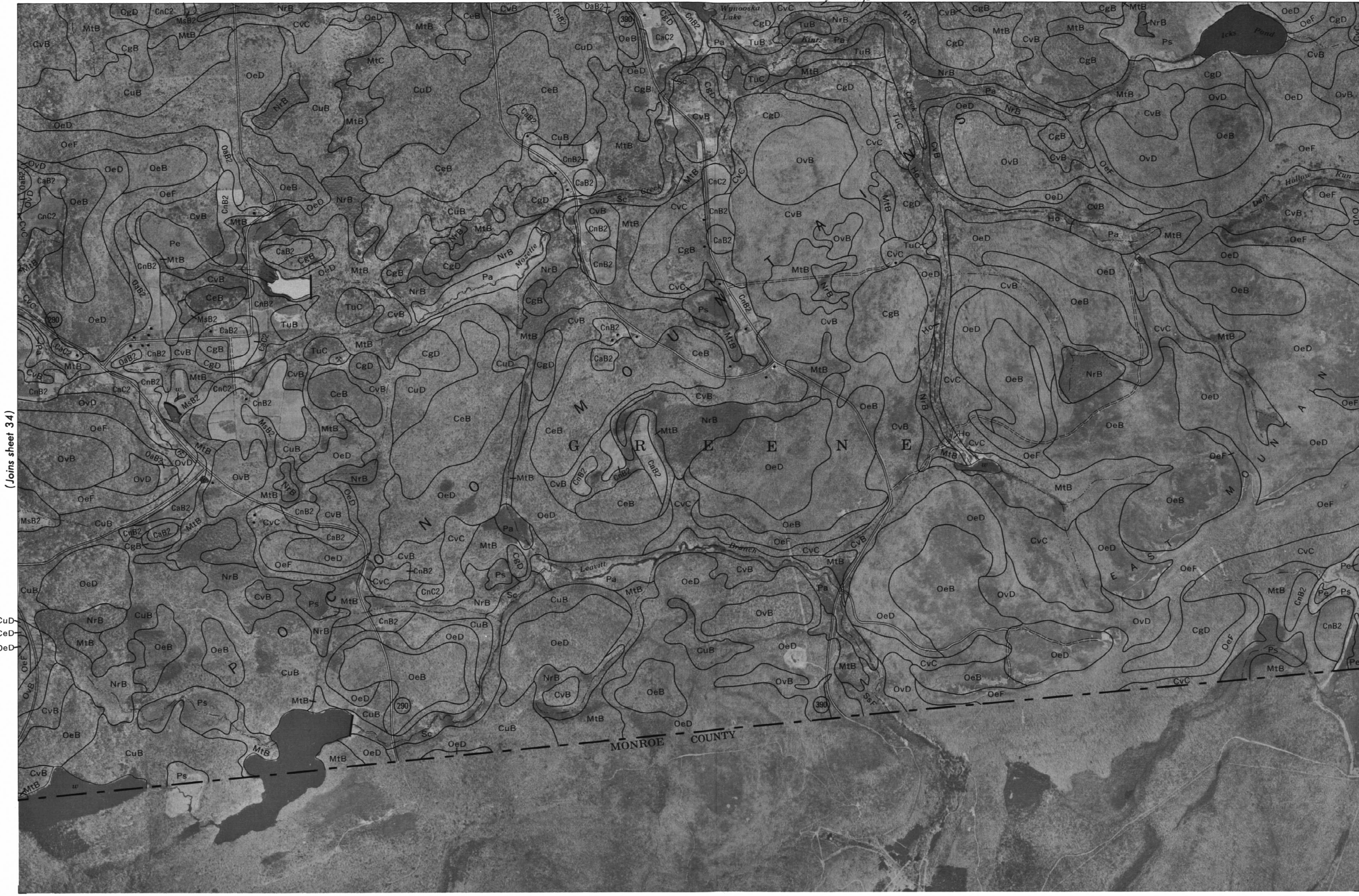

*(Joins sheet 35)*

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 34

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

(Joins sheet 28)

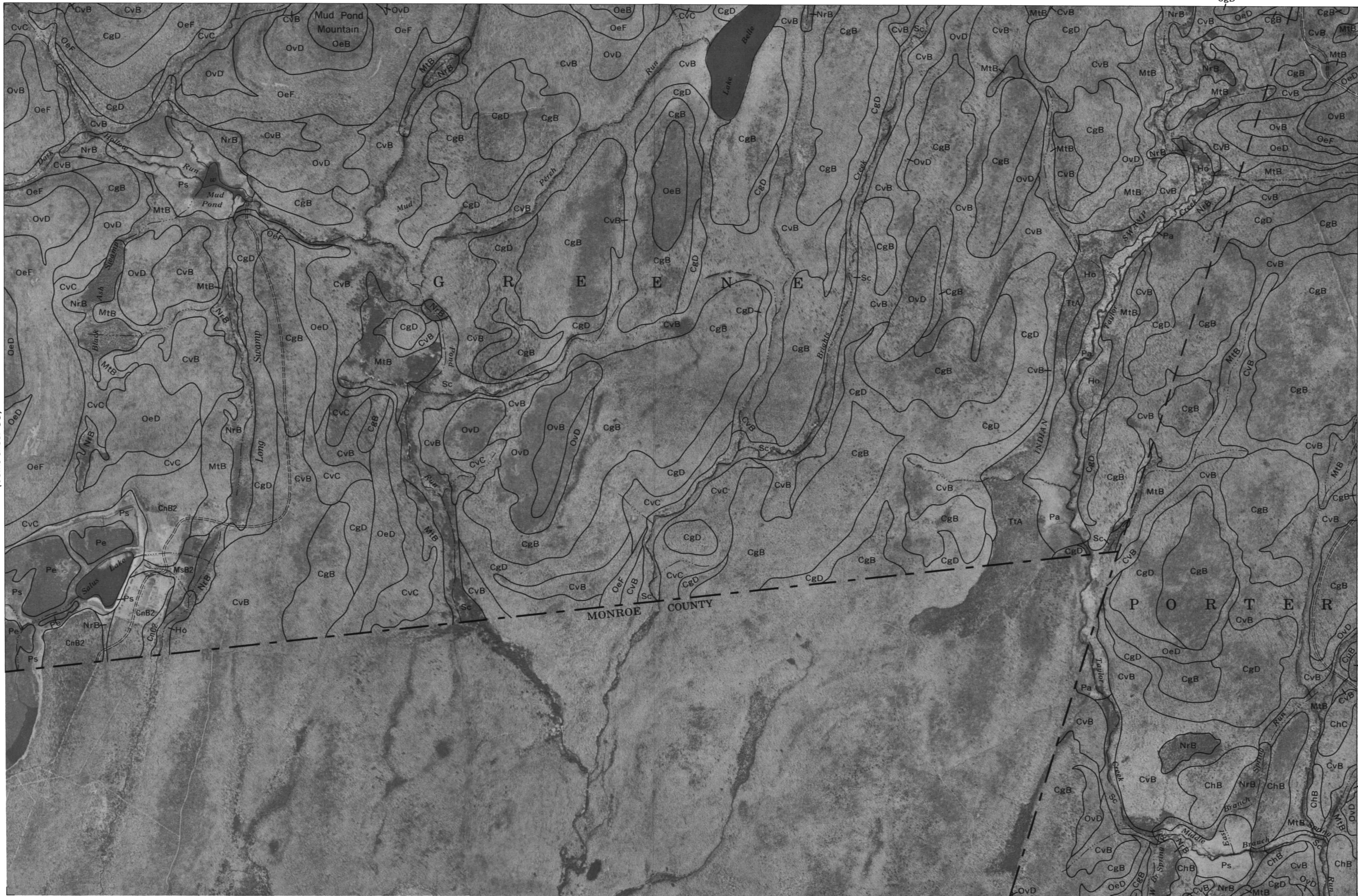



0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 35

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

(Joins sheet 29)




(Joins sheet 35)

(Joins sheet 37)

(Joins sheet 40)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet



This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

(37)


0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

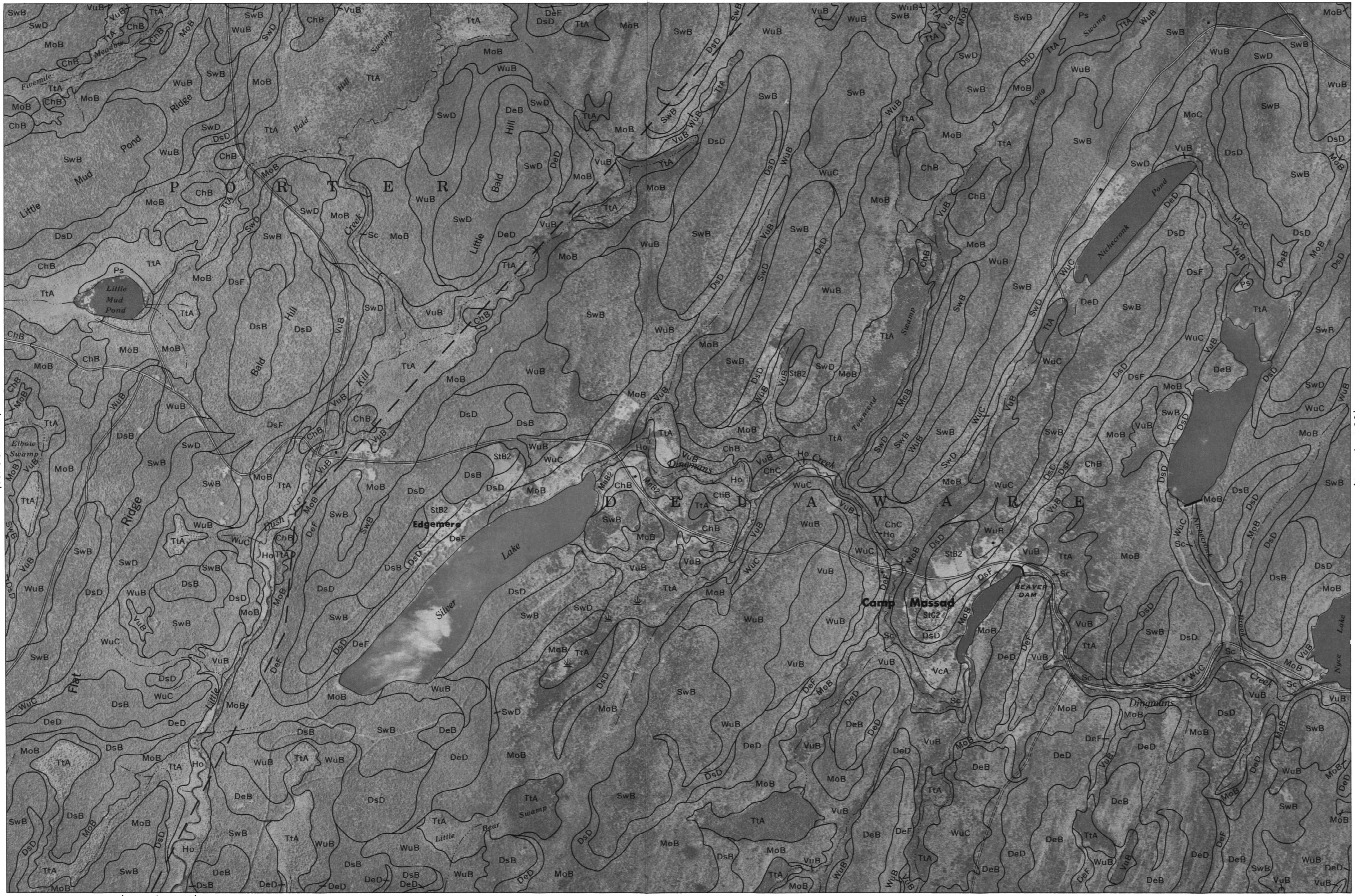
PIKE COUNTY, PENNSYLVANIA SHEET NO. 37

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

(38)

(Joins sheet 31)

(Joins sheet 37)




(Joins sheet 39)

(Joins sheet 42)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 38

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

39

(Joins sheet 32)

(Joins sheet 38)


(Joins sheet 43)

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

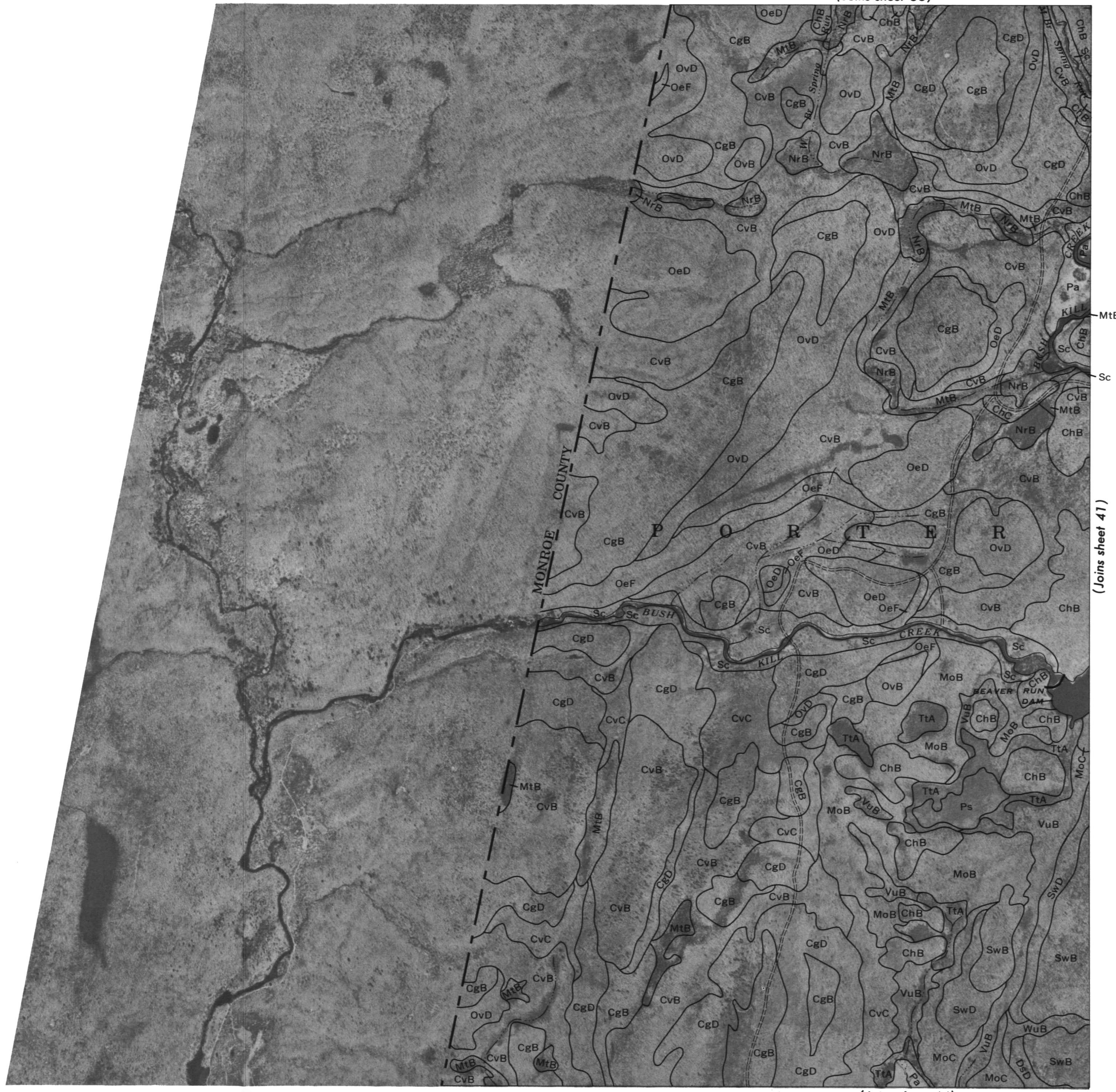
PIKE COUNTY, PENNSYLVANIA SHEET NO. 39

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

PIKE COUNTY, PENNSYLVANIA — SHEET NUMBER 40

N

(Joins sheet 36)




(Joins sheet 41)

(Joins sheet 44)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 40

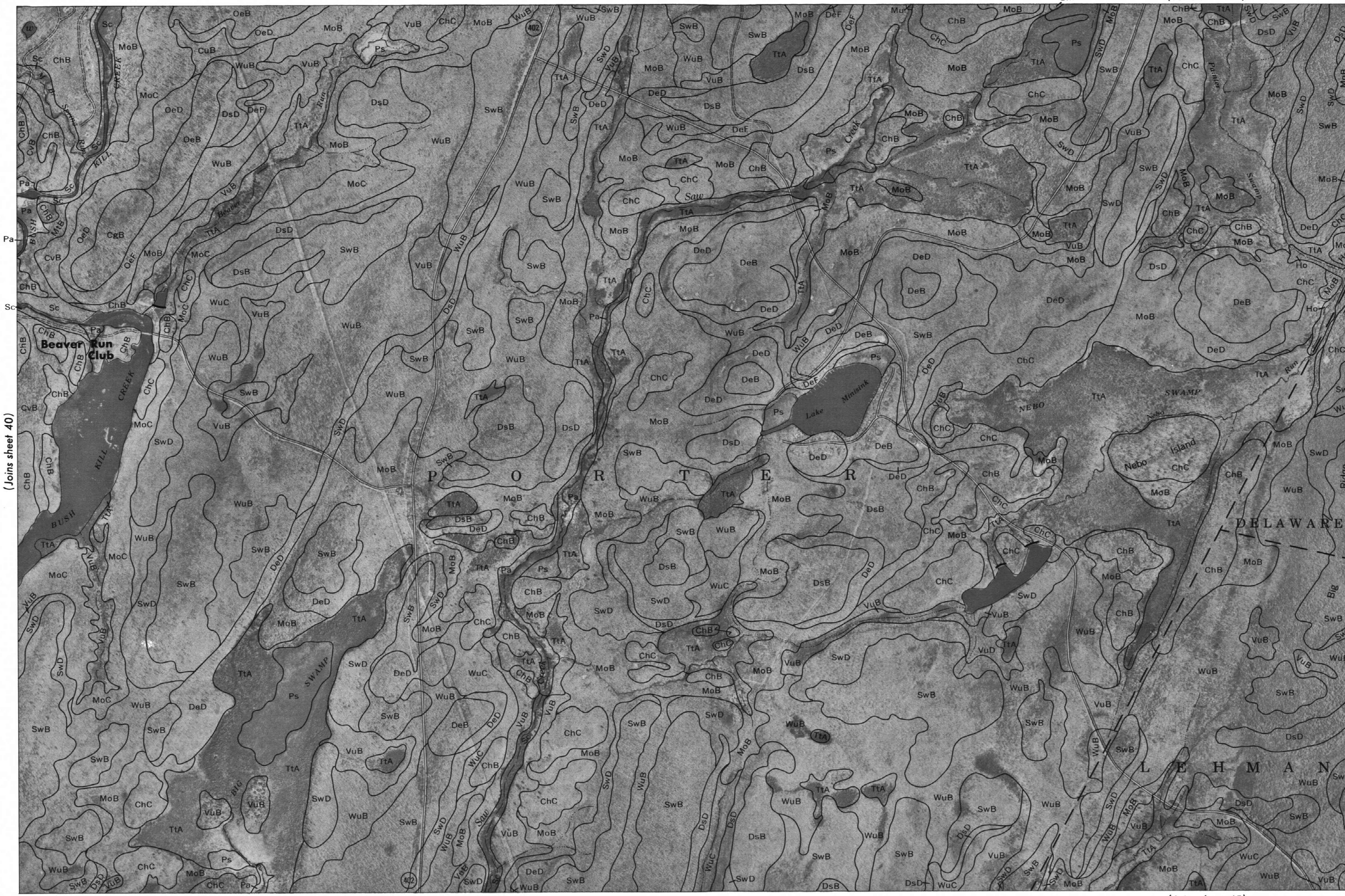
This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

41

(Joins sheet 37)

(Joins sheet 40)

(Joins sheet 42)




(Joins sheet 45)

0 ½ 1 Mile
Scale 1:20 000
0 5 000 Feet

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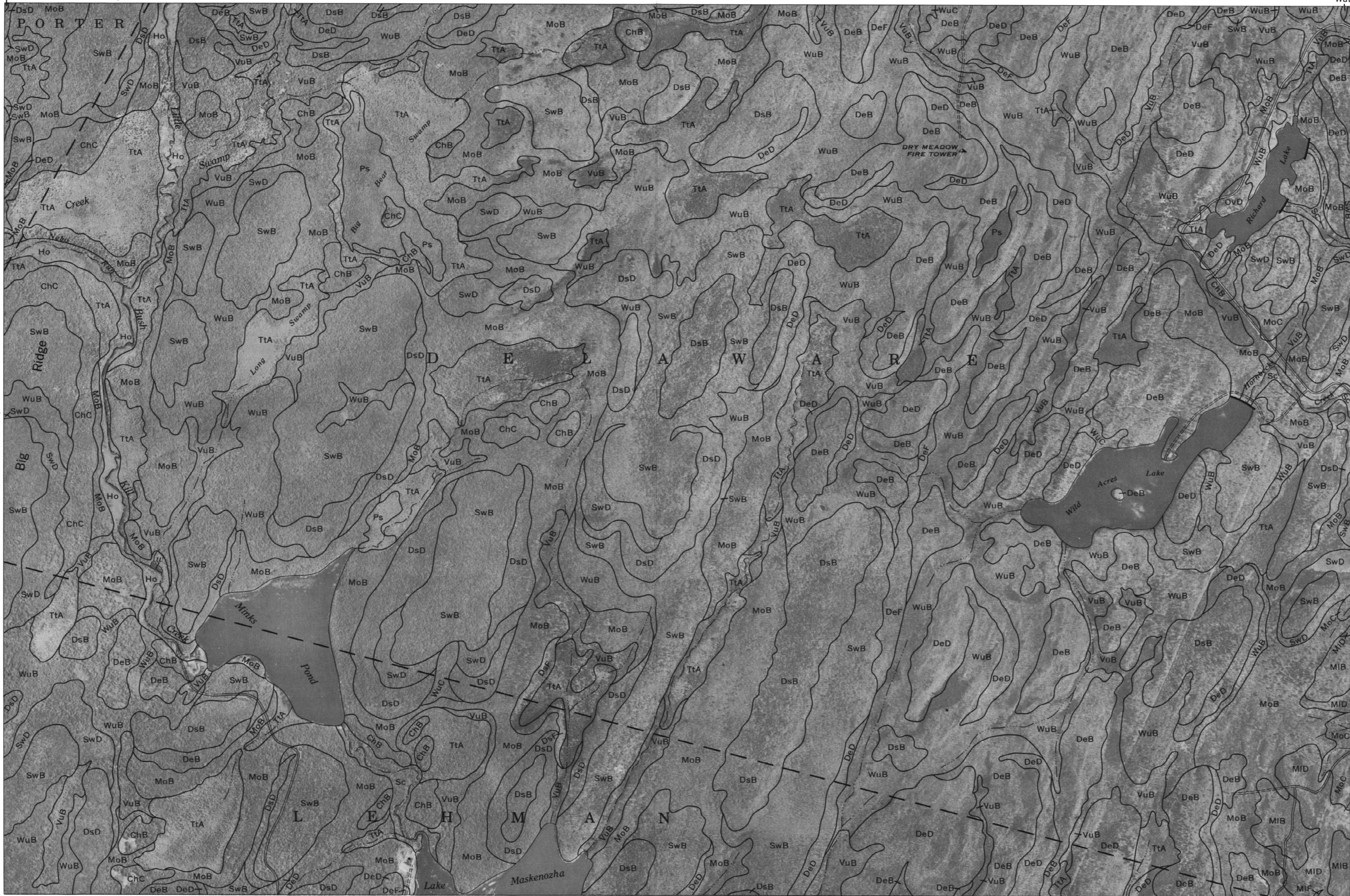
PIKE COUNTY, PENNSYLVANIA SHEET NO. 41

PIKE COUNTY, PENNSYLVANIA — SHEET NUMBER 42

(Joins sheet 38)

(Joins sheet 41)




(Joins sheet 43)

(Joins sheet 46)

0 ½ 1 Mile

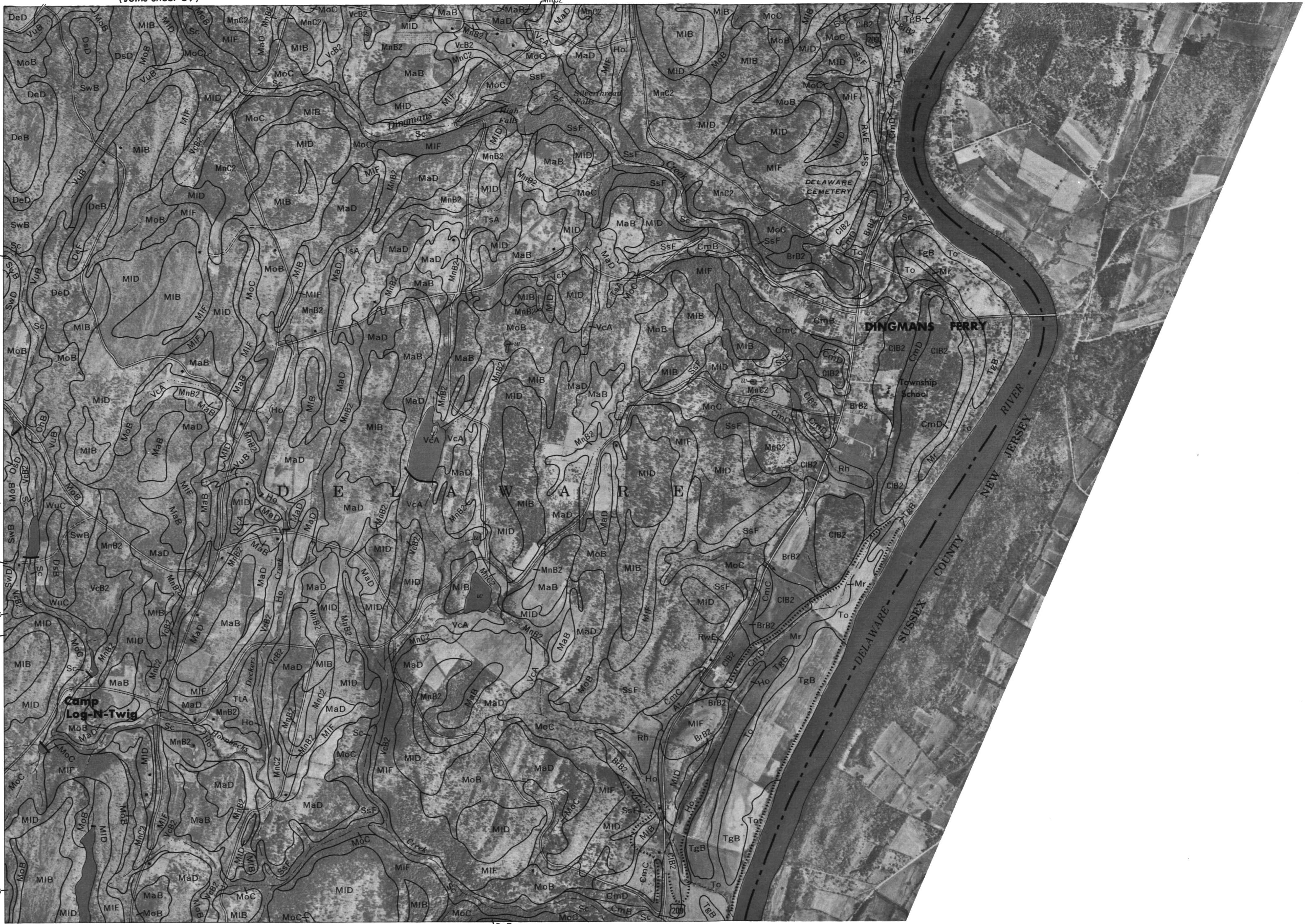
Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 42

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

(Joins sheet 39)




(Joins sheet 47)

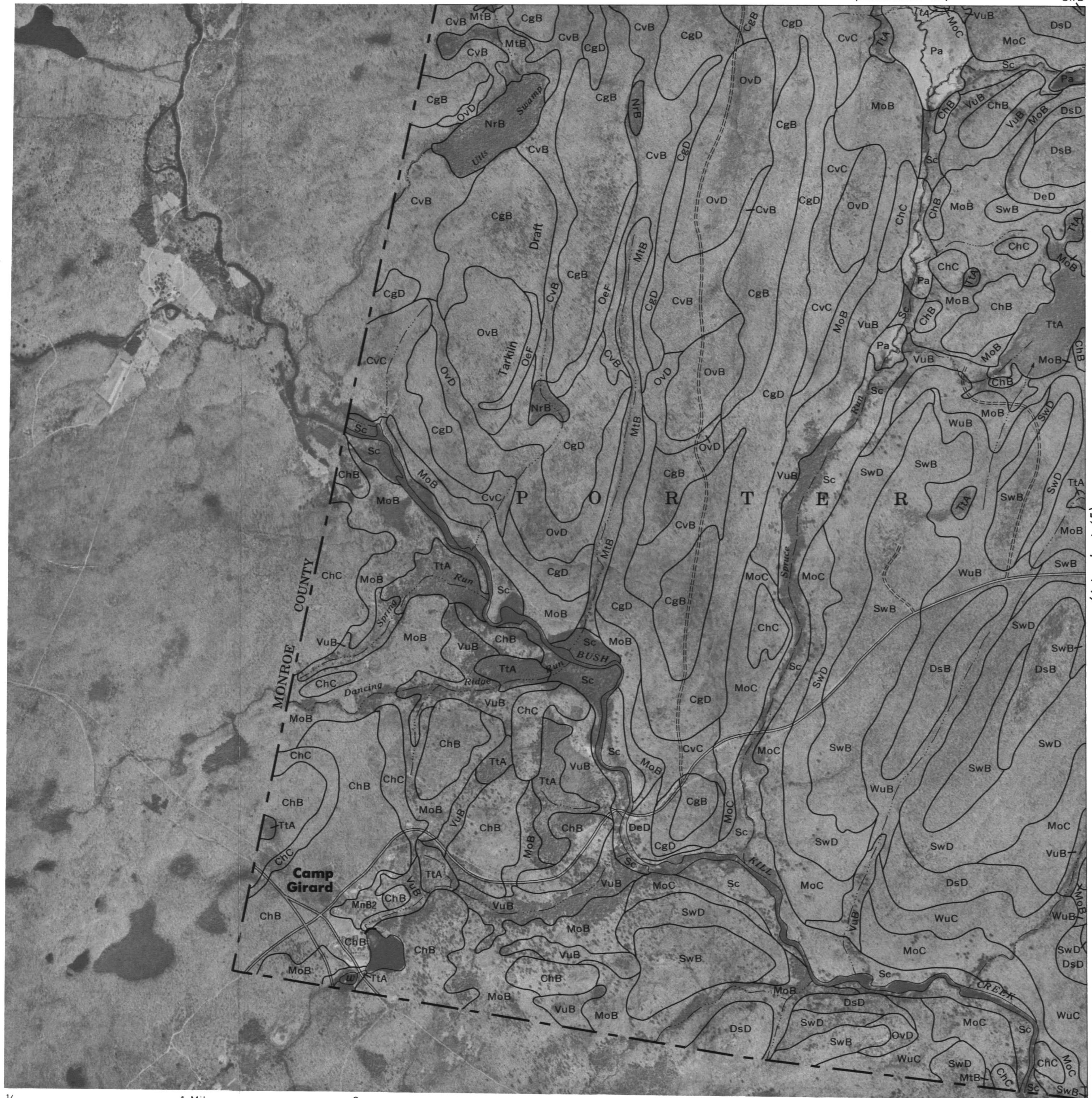
0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 43

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

# PIKE COUNTY, PENNSYLVANIA — SHEET NUMBER 44

N




0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

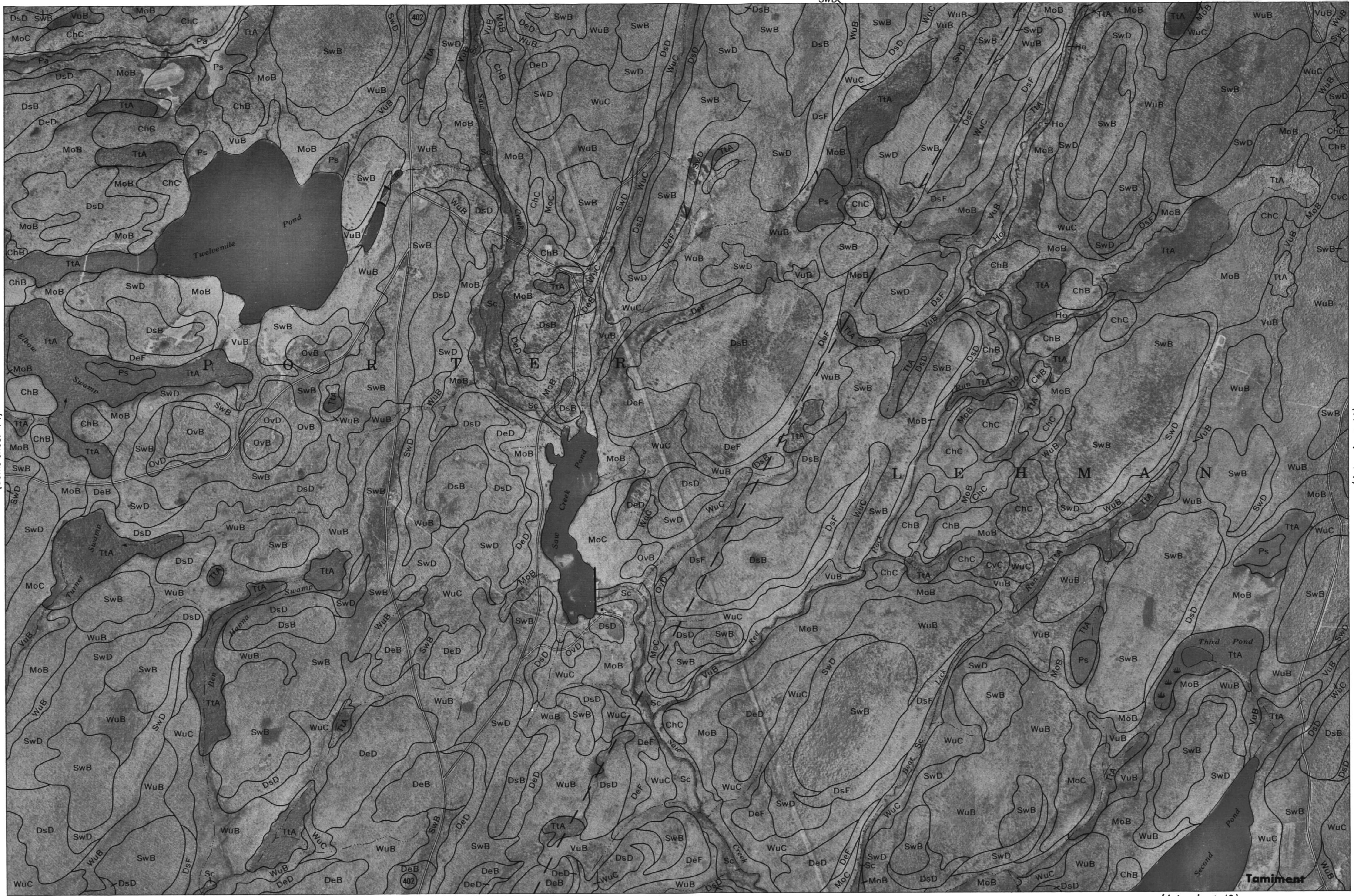
PIKE COUNTY, PENNSYLVANIA SHEET NO. 44

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

(Joins sheet 41)

N

(Joins sheet 44)




(Joins sheet 46)

(Joins sheet 48)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

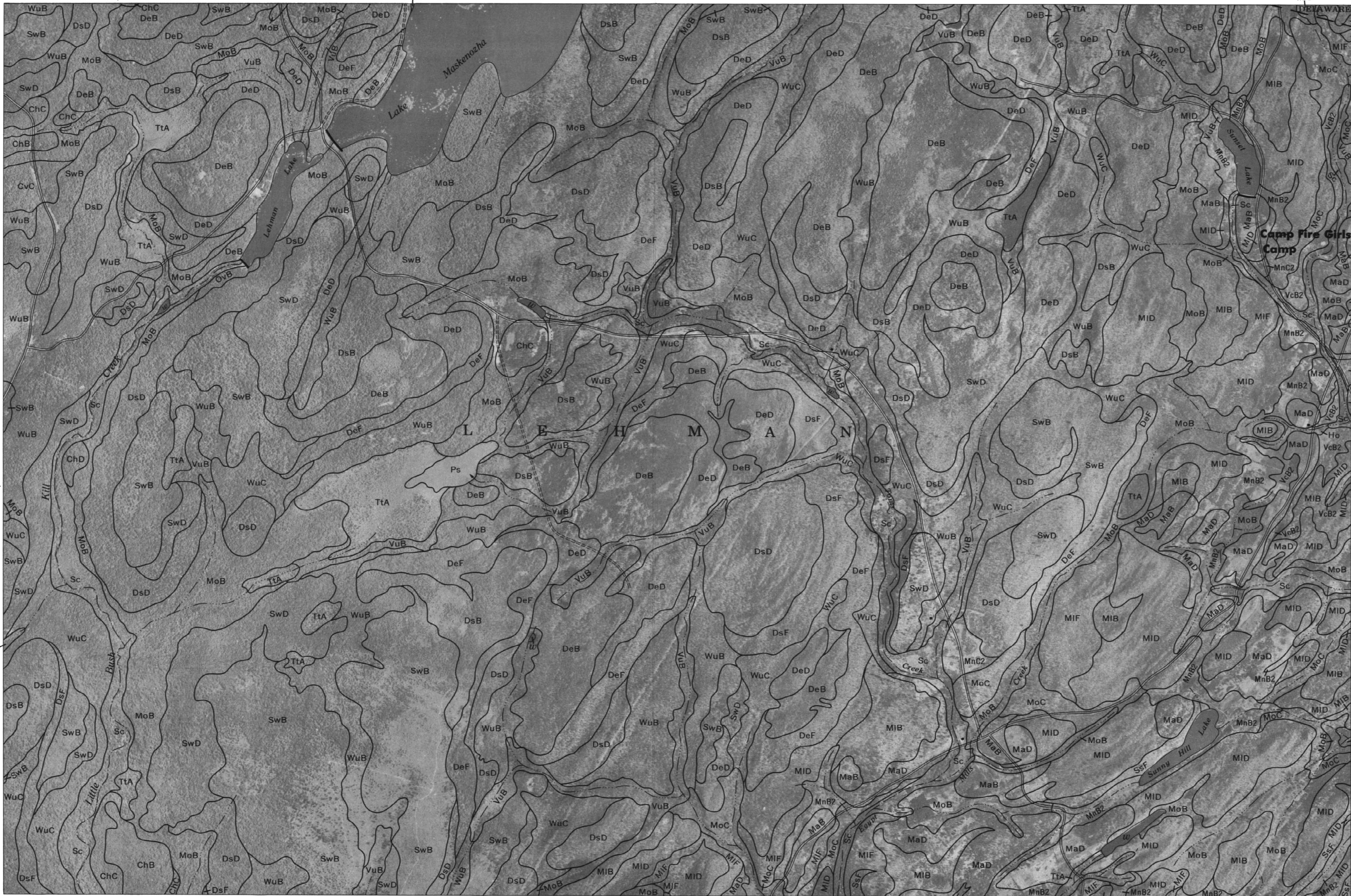
PIKE COUNTY, PENNSYLVANIA SHEET NO. 45

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

N

(Joins sheet 42)

(Joins sheet 45)




(Joins sheet 47)

(Joins sheet 49)

0 ½ 1 Mile

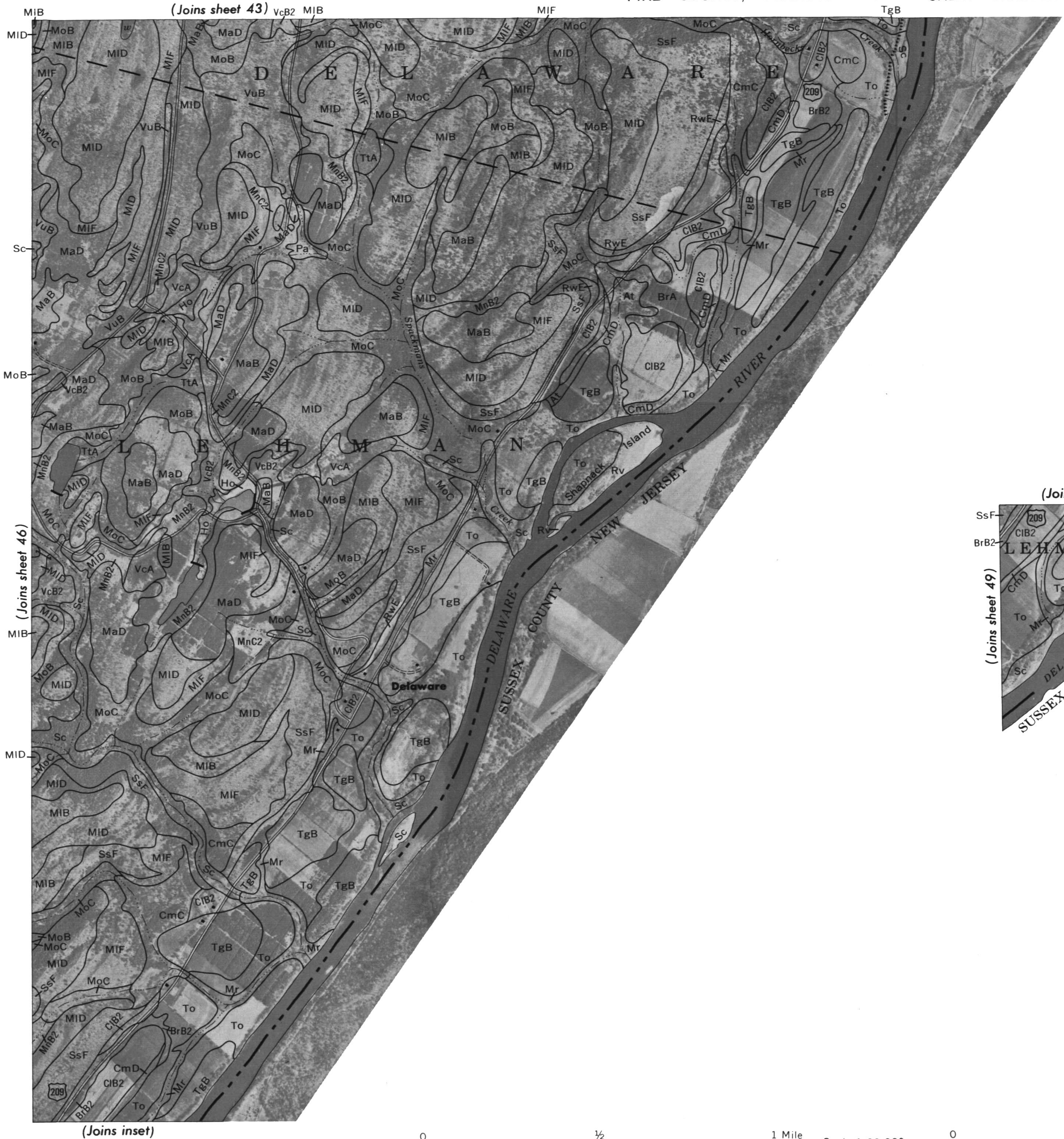
Scale 1:20 000

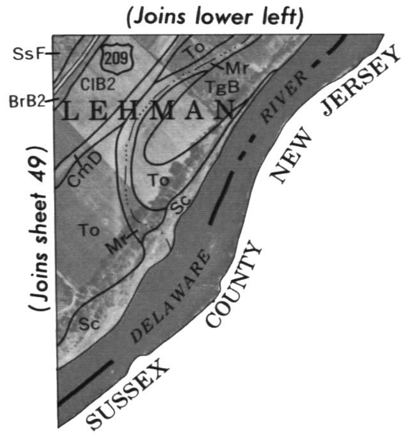
0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 46

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

N



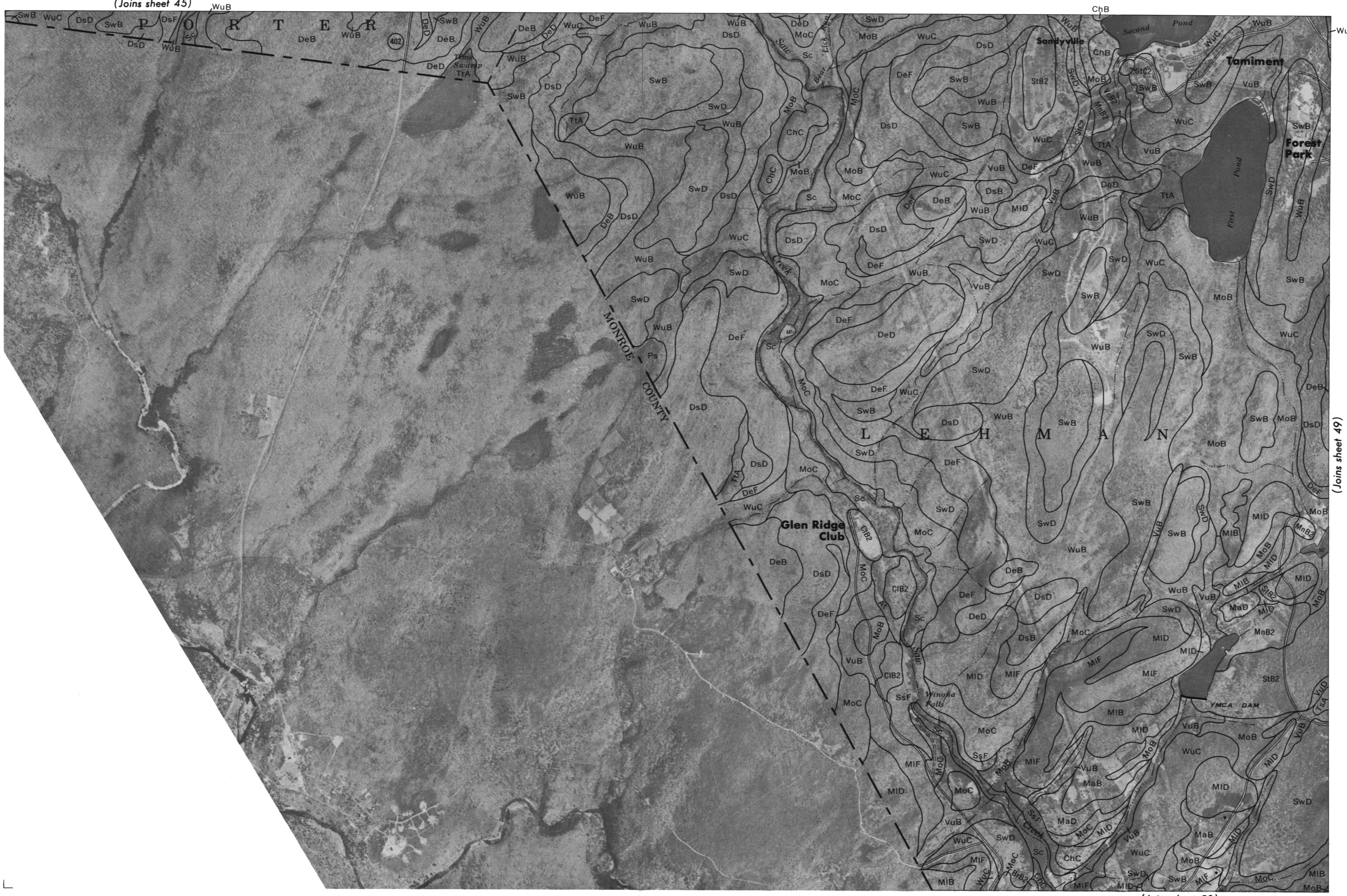

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 47

This map is one of a set compiled in 1968 as part of soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.




0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 48

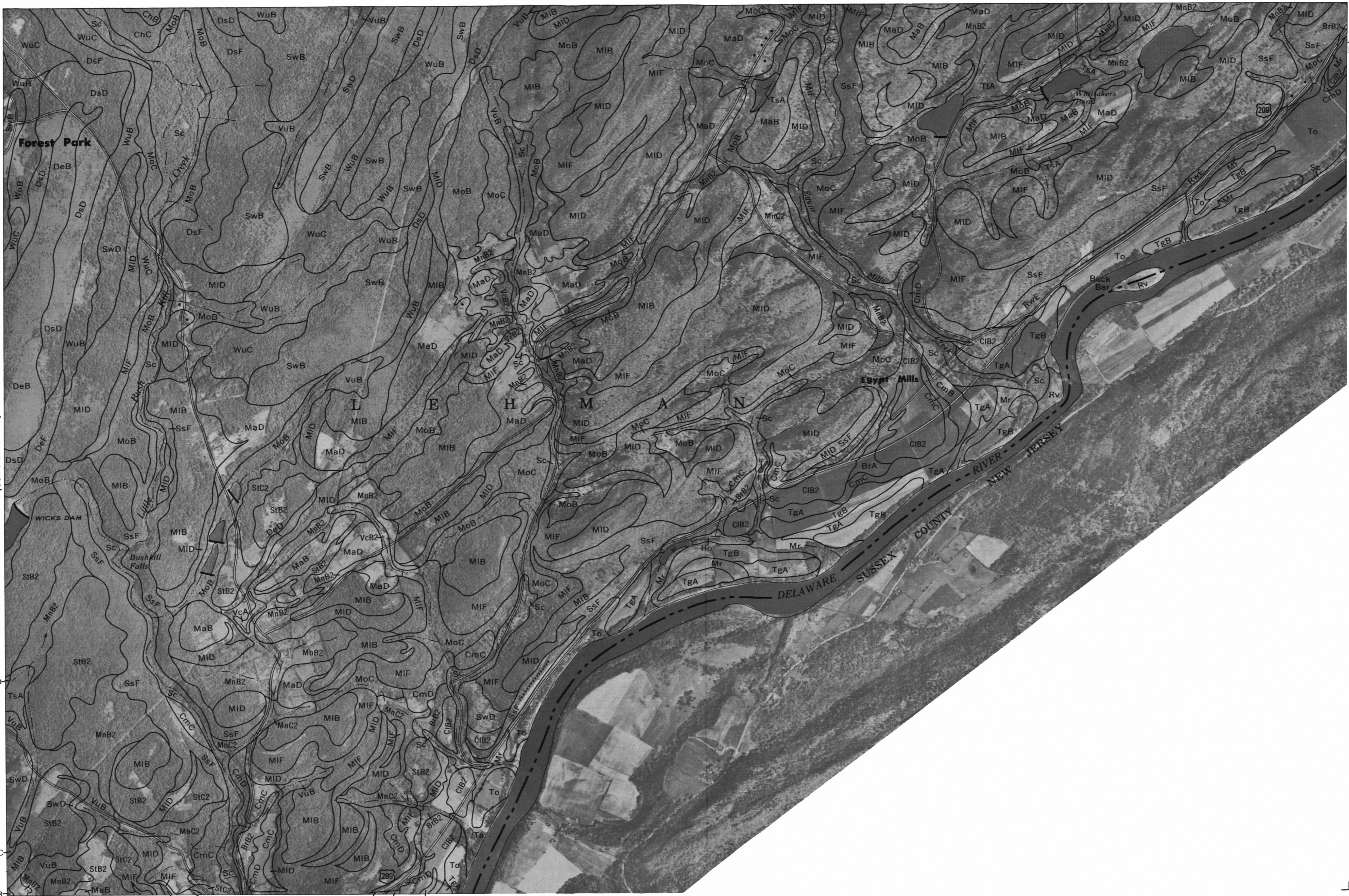
This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.

49

(Joins sheet 46)

(Joins sheet 48)

(Joins inset, sheet 47)




(Joins sheet 50)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet



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PIKE COUNTY, PENNSYLVANIA — SHEET NUMBER 50

(Joins sheet 48) | (Joins sheet 49)

N


0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

PIKE COUNTY, PENNSYLVANIA SHEET NO. 50

This map is one of a set compiled in 1968 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission.